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DEPARTMENT OF GEOLOGY

ORDOVICIAN AND SILURIAN OF THE NORTHERN ROCKY MOUNTAINS  
BETWEEN PEACE AND MUSKWA RIVERS, BRITISH COLUMBIA

by

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A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES IN PARTIAL  
FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR  
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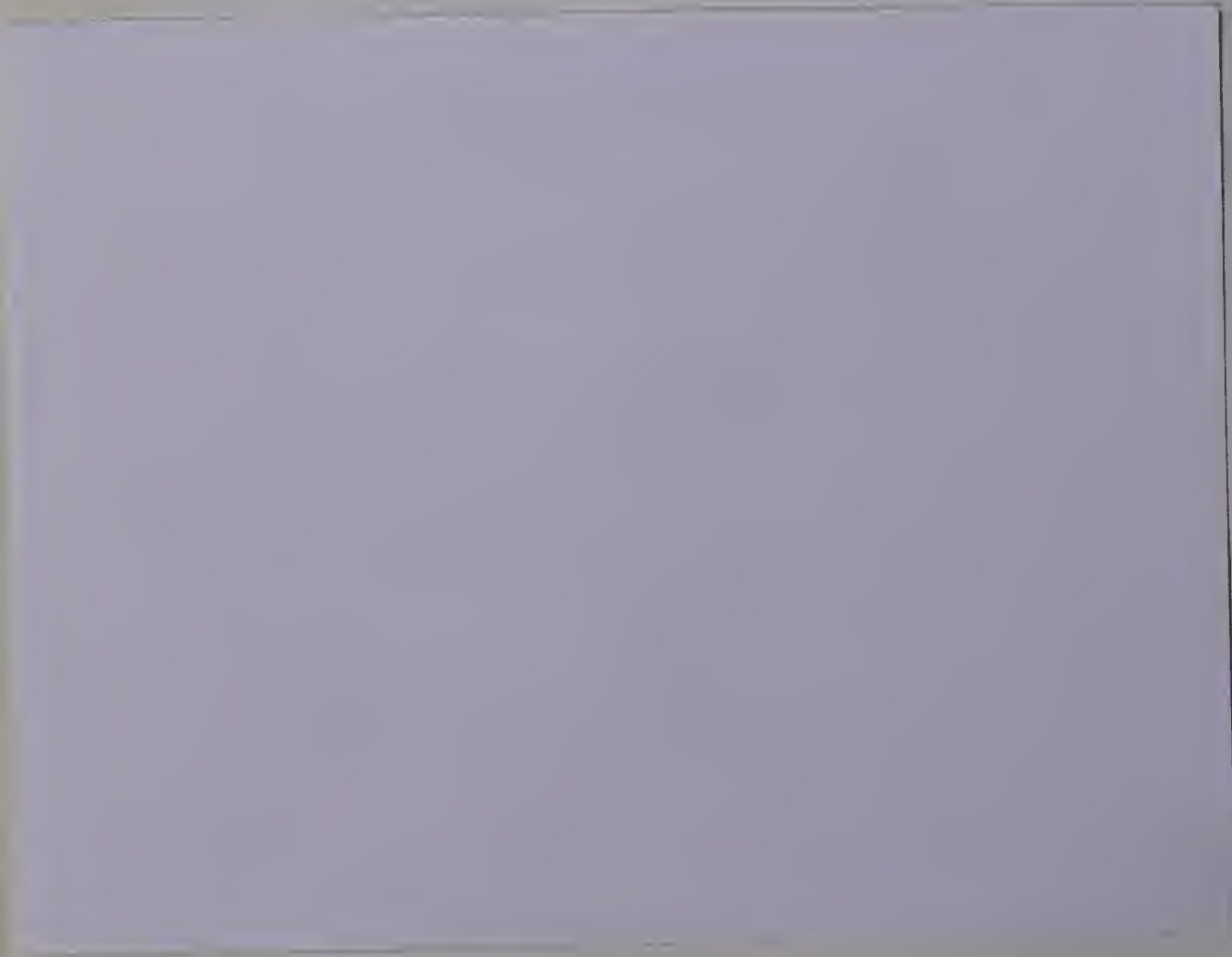
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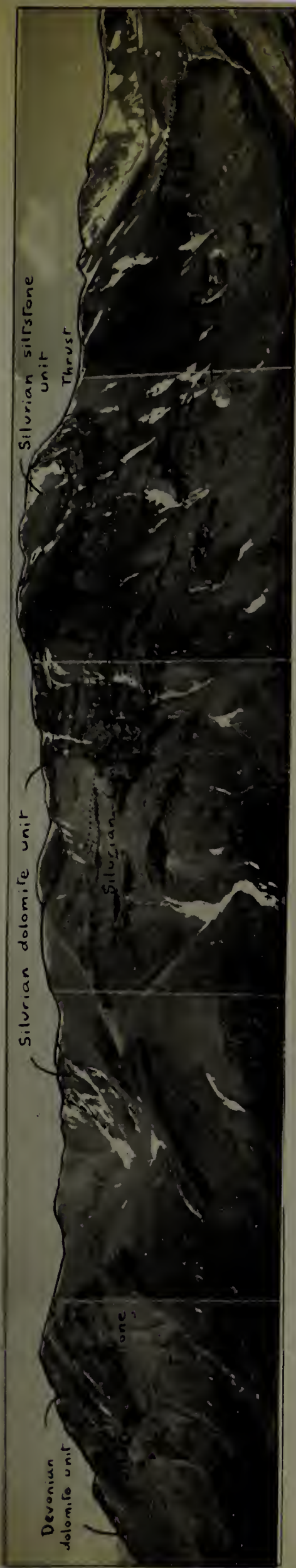
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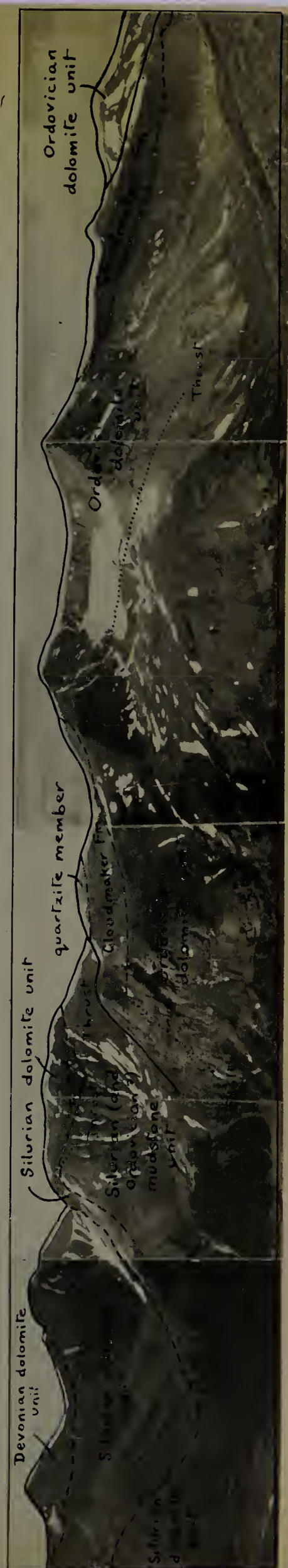
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a) South side of Slade Creek Valley



b) South side of Calnan Creek Valley



## ABSTRACT

Ordovician and Silurian rocks in the northern Rocky Mountains fall into three facies: platform carbonates are present in the eastern belt but westwards they pass through a mixed facies, which is well developed in the Halfway River area, into eugeosynclinal calcareous mudstones and graptolitic siltstones and shales. Sandstones are present but subordinate in all three facies.

The Ordovician and Silurian sequence is continuous in the mixed facies but to the west, in the eugeosynclinal facies, the distribution of rock units is governed to some extent by an unconformity which separates the Silurian and Ordovician successions. The Silurian Sandpile Group oversteps the Ordovician Cloudmaker Formation northwards and it is also probable that onlapping relationships exist within the early Silurian succession, as the age of the base of the Sandpile Group likely decreases northwards.

Faunal and lithological control is sufficiently detailed to permit correlation of the eugeosynclinal rock units with the platform carbonates. The Canadian is represented by argillaceous carbonates and calcareous mudstones of the Mount April Formation. The clay content of this unit increases westwards, and on Cloudmaker Mountain, trilobites probably representing Zones D, G, and H of Utah were collected. The Mount April Formation is overlain conformably in the eugeosynclinal facies by the Cloudmaker Formation in which nine graptolite zones from the Didymograptus protobifidus Zone through to the latest Ordovician Dicellograptus complanatus ornatus Zone are present. The Didymograptus protobifidus and Nemagraptus gracilis Zones are recorded for the first time in northern British Columbia. The base of the Cloudmaker rises stratigraphically eastwards and in the mixed facies lies in the Climacograptus bicornis Zone. In the mixed facies, the Mount April Formation is overlain conformably by an unnamed dolomite unit which contains a Middle Ordovician shelly fauna. This dolomite unit is thus the facies equivalent of the lower



part of the Cloudmaker Formation in the eugeosynclinal facies. Platform carbonates in sections measured just north of the Peace River contain an Upper Ordovician brachiopod fauna which is very similar to that present in the Maquoketa Shale of Iowa.

Three graptolite zones are recognized in the Sandpile Group in the eugeosynclinal facies and the zones of Monograptus cyphus and M. spiralis are recorded for the first time. In the mixed facies, an unnamed mudstone unit contains diplograptid graptolites assigned, with qualification, to the zone of Diplograptus modestus. This mudstone unit is separated from contemporaneous platform dolomites by a transitional facies of laminated argillaceous dolomites. The platform dolomites carry a rich shelly fauna of Llandoveryan and possibly Richmondian age. The Sandpile coralline member fauna, which is known from the Cassiar Mountains, is widespread throughout the platform and mixed facies. In the latter, the Silurian dolomite unit is overlain by a thick siltstone unit which carries graptolites of the Monograptus spiralis Zone at its base. This siltstone unit also carries a scant coral fauna.

More than 80 species or varieties of graptolites are recorded for the first time from northern British Columbia and several for the first time from Canada. All the shelly faunas have a distinct Pacific aspect.



## ACKNOWLEDGEMENTS

The writer extends deep appreciation to Dr. D.E. Jackson, under whose supervision this study was carried out, for his helpful advice and encouragement throughout. Sincere thanks are also extended to Dr. C.R. Stelck for his help with the studies on the shelly faunas.

To Shell Canada Ltd., the writer extends his gratitude for the loan of fossils and camping equipment, and for drafting the enclosures. In particular, the writer thanks Dr. P.A. Ziegler for pointing out the intricate facies changes which are present in the Halfway River area, and for advice relating to the field work.

Dr. B.S. Norford kindly examined a suite of Silurian shelly fossils and also furnished lithological descriptions and fossil identifications from the Clearwater Creek section in the Pine Pass Map-area. The Geological Survey of Canada loaned comprehensive graptolite collections from the Ware Map-area and the writer thanks Dr. G.C. Taylor for supplying stratigraphic details of the collections.

Hudson's Bay Oil and Gas Co. Ltd. and Pan American Petroleum Corporation are thanked for the loan of lithological samples and fossils.

Photography was by Mr. F. Dimitrov and competent field assistance was provided by Mr. D. Stelck and Mr. W. Marsh. The writer expresses his thanks to his wife, Gillian, and to Mrs. P. McIntyre for typing the manuscript.

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## CHAPTER 1: INTRODUCTION

### Purpose and scope of study

The Ordovician and Silurian of the northern Rocky Mountains are imperfectly known in detail and the purpose of this dissertation is to describe the facies, their relationships and distribution, and the stratigraphic paleontology.

Very few studies on the faunas of the region have been carried out and until the present no graptolites or Ordovician fossils from northeastern British Columbia had been illustrated. It is hoped that the results of the study will materially aid further work in this area.

### Location and access

The study area falls entirely within the Rocky Mountains, between latitude  $56^{\circ}\text{N}$  (Peace River) and latitude  $58^{\circ}\text{N}$  (Figure 1). It is covered by the National Topographic Series of maps (1:250,000): 94B (Halfway River); 94F (Ware); and 94G (Trutch).

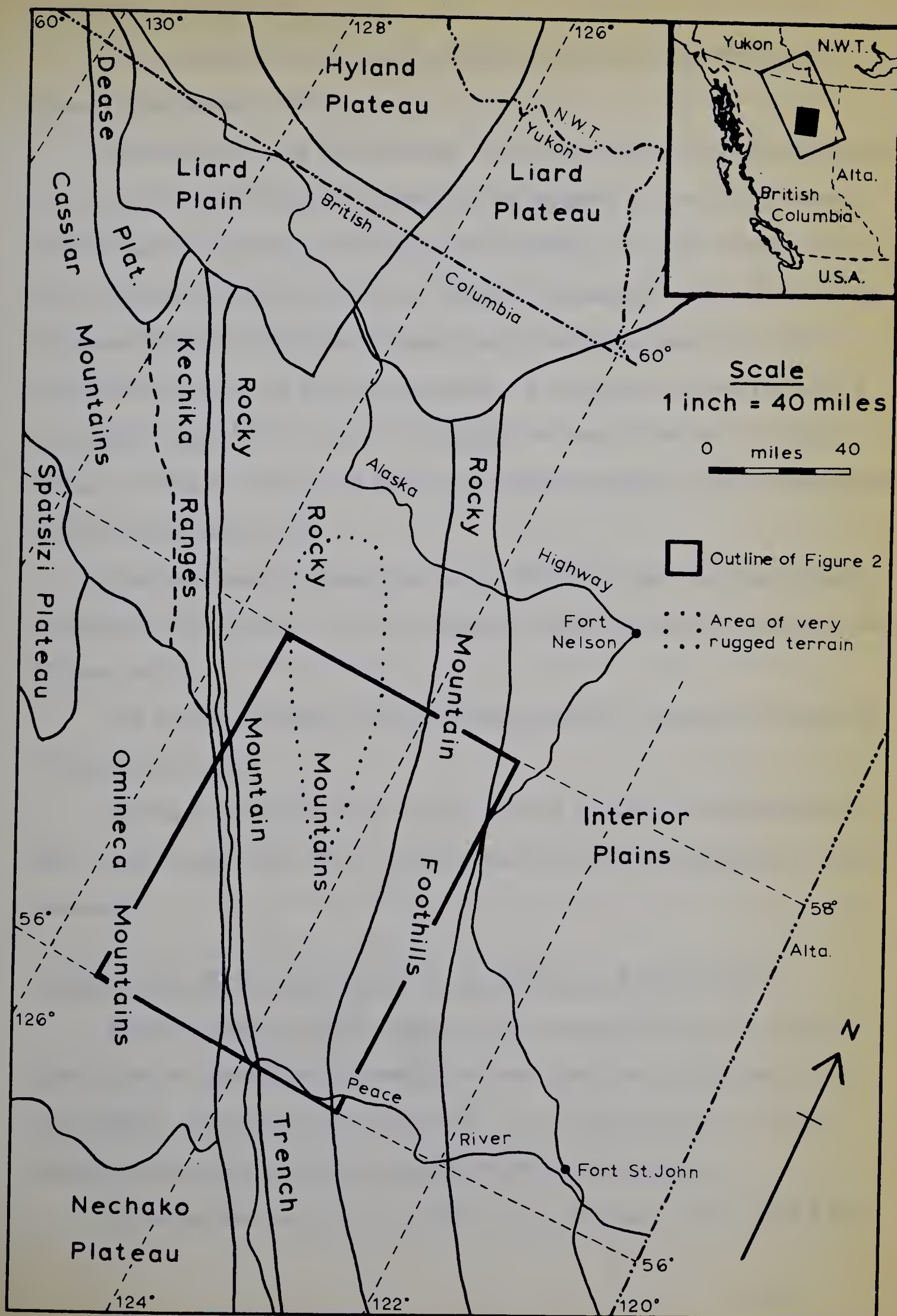
There are no roads in the study area and travel without a helicopter is generally difficult. Float planes operate out of Fort St. John and Fort Nelson on the Alaska Highway, which lies some fifty miles to the east. Lakes known to the author to permit landing are (from north to south) Quentin, Haworth, Chesterfield, Redfern, Trimble and Lady Laurier.

Trails east of the Cariboo divide are frequently used by hunting parties and are in good condition. West of the divide, the Finlay and, reportedly, the Ospika River are followed by good trails. Access to the Finlay River is via the Peace River in the south and via the Muskwa River and Warneford Creek in the north. The terrain between the Finlay River and the Cariboo divide is particularly rugged and travel is difficult.

The Peace and Finlay Rivers are navigable over much of their length.



Figure 1. PHYSIOGRAPHIC DIVISIONS AND LOCATION OF THESIS AREA  
(Physiography after Bostock, 1948)





### Physiography and regional geology

The physiographic divisions of northeastern British Columbia are shown in Figure 1 (after Bostock, 1948).

The boundary of the Interior Plains, which are underlain by Cretaceous sedimentary rocks, with the Foothills is marked by the incoming of more or less rounded hills but north of the Sikanni Chief River this boundary is not well defined. The Foothills are formed of Mesozoic and Upper Paleozoic sedimentary rocks. The first ranges of resistant Paleozoic rocks mark the beginning of the Rocky Mountains which are formed of Proterozoic and Paleozoic sediments. In northeastern British Columbia a particularly rugged "core" is surrounded by peaks of lesser elevation. The Liard Plateau in the north is an area of broad, even-topped ranges made up of Mesozoic and Paleozoic sedimentary rocks.

The Rocky Mountain Trench and the Liard Plain are low lying areas largely covered with glacial drift. The Dease Plateau is largely underlain by Paleozoic sedimentary rocks.

The Cassiar and Omineca Mountains are dominantly composed of crystalline or metamorphic rocks.

Ordovician and (or) Silurian rocks are known to crop out in the Rocky Mountains, Liard Plateau, Liard Plain, Dease Plateau, and Kechika Ranges of the Cassiar Mountains.

### Previous work on Ordovician and Silurian of northeastern British Columbia

Dawson (1889, page 94B) reported the occurrence of Ordovician shales on Dease River and graptolites collected by him were identified and discussed by Lapworth (1889). McConnell (1890, page 37D), on lithological grounds, equated shales on the Liard River with the Ordovician shales on Dease River.

On an exploration of the Finlay River area, McConnell (1896, page 24C)



equated widespread grey limestones with the Cambro-Ordovician Castle Mountain Group of the southern Rocky Mountains. He also descended the Peace River for a short distance below the confluence with the Finlay River and collected the chain coral Halysites which he stated (1896, page 35C) was "probably Silurian in age".

Dolmage (1928) also explored the Finlay River area and his work further extended the known distribution of the grey limestone beds.

Hedley and Holland (1941) reconnoitred the area of the Turnagain and Upper Kechika Rivers and collected Silurian and possibly Upper Ordovician fossils from a limestone group.

Construction of the Alaska Highway considerably aided exploration. Williams (1944) conducted geological investigations between Fort Nelson and Watson Lake and discovered fossiliferous Silurian limestones resting on unfossiliferous clastics. Williams equated these clastics with Cambrian clastics in the Franklin Mountains. Laudon and Chronic (1947; 1949) applied the name "Ronning" to the Silurian limestones - a name originally used by Link (unpublished Imperial Oil report) for Silurian carbonates in the MacKenzie Mountains. Vail (1957) briefly discussed the Silurian limestones in the Racing River area.

Sutherland (1958, page 5) measured a section in Ordovician strata on the Calnan Creek—Slade Creek divide and collected some macluritid gastropods.

The first detailed paleontological study was by Norford (1959; 1962a). Norford described the geology of the Turnagain River area and also made a systematic study of the Silurian fauna of the Sandpile Group. The disconformable contact of the Sandpile with the underlying Kechika Group was also discussed in some detail (1962a, page 3). Jull (1961) studied the Silurian Halysitidae of western Canada and much of his material was from northeastern British Columbia.

Gallant (1962) briefly discussed the Lower Paleozoic section along the Peace River.



Tedrick (1962) studied the Ordovician of the Prophet River area with particular reference to lithology and paleogeography.

Gabrielse (1963) gave a comprehensive account of the geology of the McDame area and discussed the Ordovician and Silurian in some detail. Fossil identifications from several collections are also included.

Cosburn and Callan (1963) presented a preliminary geological report on the Redfern Lake area and included a brief discussion of Silurian dolomites.

Irish (1964) gave an account of the Lower Paleozoic strata of the Halfway River Map-area and recorded representative fossil identifications.

The field work for Operation Liard has now been completed. Progress reports by Taylor (1965; 1966) indicate that Middle Ordovician strata are unconformably overlain by Lower Silurian. Eastward thinning and truncation characterize the Ordovician and Silurian. Of particular interest is the report (Taylor, 1965, page 66) of volcanic rocks in the Ordovician graptolitic facies.

The first detailed study of the graptolite faunas of northeastern British Columbia was that of Jackson, Steen, and Sykes (1965) who erected a zonal scheme for the Sandpile and Kechika Groups and evidenced the sub-Sandpile unconformity. The Sandpile was shown to overstep the Kechika Group northwards from Akie River to Cloudmaker Mountain.

A summary account of work in northeastern British Columbia up to 1950 is given by McLearn and Kindle, and more recently, Norford (1964) has given a comprehensive account of the Ordovician and Silurian of the Cordillera of western Canada.

Ordovician and Silurian rock units have been mapped by the Geological Survey of Canada in the following map areas: McDame (Gabrielse, 1954; 1963); Cry Lake (Gabrielse, 1962a); Kechika (Gabrielse, 1962b); Rabbit River (Gabrielse, 1962c); Pine Pass (Muller, 1961); Halfway River (Irish, 1963); and MacDonald Creek (Taylor, 1963). In addition, detailed geological maps of the Peace River area are included



in the Edmonton Geological Society Guidebook for 1962.

### This study

In 1964, two weeks were spent in the Cloudmaker Mountain area measuring sections and collecting fossils. Travel from Fort Nelson to the Cloudmaker Mountain area and back was by float plane which landed on Chesterfield Lake.

In 1965, four weeks were spent measuring sections and collecting fossils in the Halfway River area. Travel from Fort Nelson was by float plane which landed at Lady Laurier Lake prior to the arrival of the pack train and the remaining three weeks were spent working northwards to the Halfway River valley and subsequently packing out to Pink Mountain. Pink Mountain is accessible by motor vehicle from Mile 143, Alaska Highway. Previous geological exploration in this area had been undertaken by Shell Canada Ltd. in 1960 and the field map (Figure 12) of Dr. P.A. Zeigler (Party Chief) was made available to the writer. Fossils collected by Shell during the course of the mapping, together with graptolites collected in the Akie River area by another Shell party in the same year were loaned to the writer.

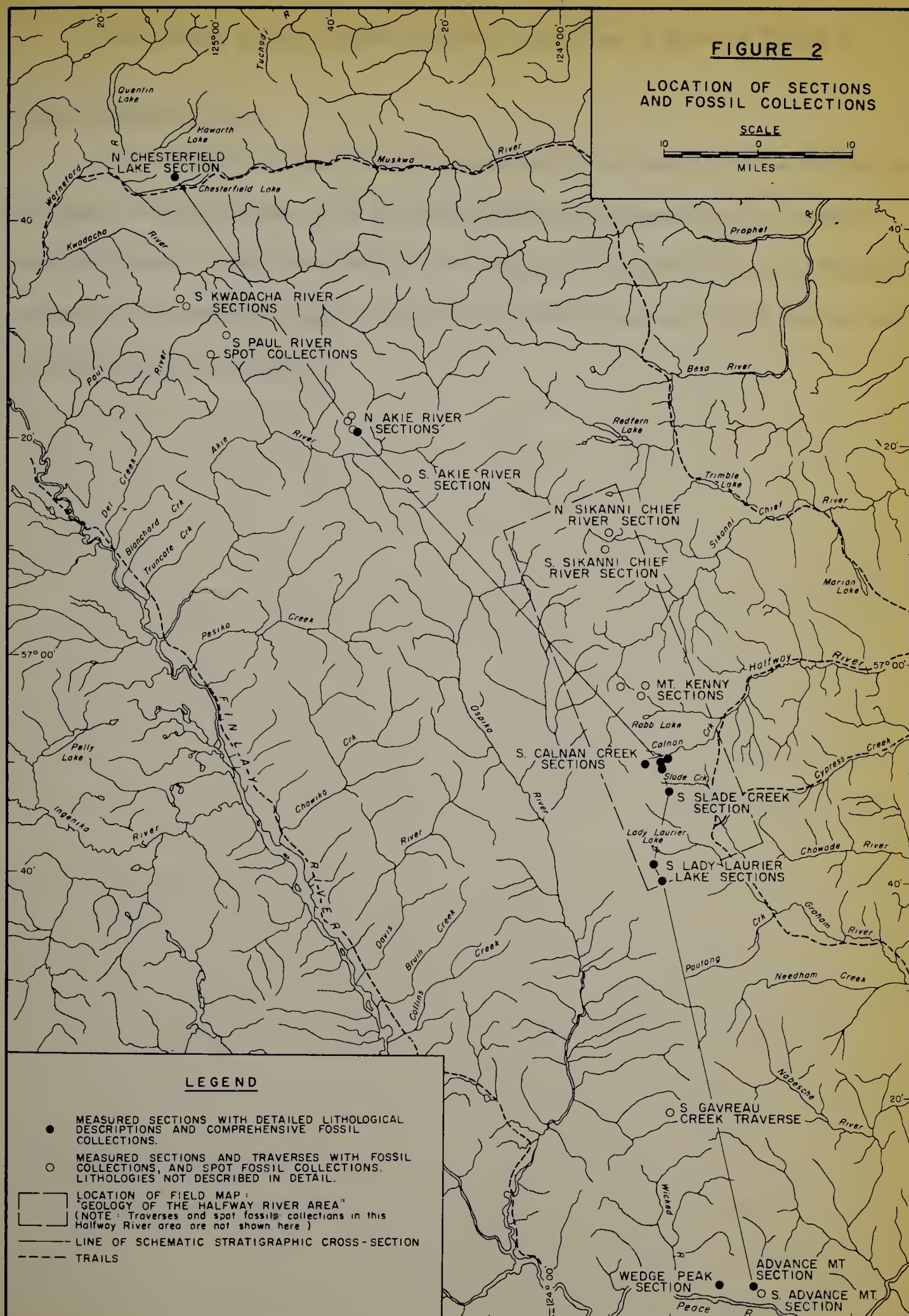
Twenty-six lots of graptolites collected by Dr. G.C. Taylor of the Geological Survey of Canada on Operation Liard in 1964 from the Ware Map-area were available for study.

Lithological descriptions and fossil identifications from the Clearwater Creek section in the Pine Pass Map-area were kindly made available by Dr. B.S. Norford of the Geological Survey of Canada. This section can be easily correlated with those in the Peace River area.

Hudson's Bay Oil and Gas Company Ltd. loaned the lithological samples of two sections measured in 1960 just north of the Peace River and also made available a list of the fossil identifications made by Dr. J. Usher of Queen's University.

Pan American Petroleum Corporation loaned fossils collected in 1961 from a section south of the Sikanni Chief River.







The location of the sections and fossil collections is shown in Figure 2.

### Economic possibilities

In the study area, the economic potential of the Ordovician and Silurian is not great. No mineralization of any consequence was observed and no reservoir rocks are present. The coarse clastic units are generally quartzitic and although the carbonates are commonly vuggy (especially the Silurian dolomite unit) they do not have intercrystalline porosity.



## CHAPTER II : STRATIGRAPHY

### Introduction

Three facies belts can be recognized in the Ordovician and Silurian of the northern Rocky Mountains. These trend northwards from the Peace River but north of the Halfway River the trend changes to north of northwest (Figure 3).

Eugeosynclinal calcareous mudstones and graptolitic shales and siltstones form the western belt and these are the lateral equivalents of platform carbonates which make up the eastern belt. A narrow belt of mixed facies intervenes between these western and eastern belts. Figure 13 is a schematic stratigraphic cross section which shows the facies changes within the Ordovician and Silurian of the northern Rocky Mountains.

Due to the many facies changes within the Ordovician and Silurian, simple nomenclature is difficult to attain. Published names are available for rock units in the eugeosynclinal belt and these have also been used for part of the succession in the mixed facies. For ease of recognition, the remaining unnamed rock units are referred to by their age (Silurian or Ordovician) and their lithology (Table 1).

### MOUNT APRIL FORMATION

The Mount April Formation was proposed by Jackson, Steen, and Sykes (1965) for a sequence of Lower Ordovician (and older?) argillaceous limestones. The type section is located on the southern face of Mount April (57° 36' 30"N, 124° 15' 00"W).

### Distribution and thickness

This formation is widely distributed in the northern Rocky Mountains. It has been mapped by McConnell (1896), Dolmage (1928), Muller (1961), and Irish (1964). This formation made up part of Unit A of Tedrick (1962).







Table 1. Nomenclature and thicknesses of rock units.

Age	CASSIAR MTS., McDAME AREA Norford (1962a), Gabrielse (1963)	NORTHERN ROCKY MTS. Jackson, Steen, and Sykes (1965)	NORTHERN ROCKY MOUNTAINS (This study)		
			EUGEOSYNCLINAL FACIES	MIXED FACIES	PLATFORM FACIES
DEVONIAN	McDame Group	-	-	Devonian dolomite unit	Devonian dolomite unit
SILURIAN	Sandpile Group (1,500 + feet)	Sandpile Group (1,212+ feet)	Sandpile Group (1,212+ feet)	Sandpile Group: 3. Silurian siltstone unit (1,463 feet) 2. Silurian dolomite unit (367 feet) 1. Silurian (and Or- dovician?) mudstone unit (655 feet)	Silurian dolomite unit (2,000 + feet) Base of unit is Ord- ovician in Peace River and Pine River areas.
ORDOVICIAN	Kechika Group (1,000-2,5000+ feet)	Cloudmaker Fm. (1,183-1,255 feet)	Cloudmaker Formation: 3. upper shale and siltstone member (85 feet) 2. quartzite member (300 feet) 1. lower shale and siltstone member (1,183 feet)	Cloudmaker Formation: 2. quartzite member (300 feet) 1. lower shale and siltstone member (1,425 feet)	Ordovician sandstone unit (110 feet)
		Mount April Fm. (4,500+ feet)		Ordovician dolomite unit (2,373 feet)	Ordovician argill- aceous carbonate unit (285 feet)
			Mount April Fm. (4,500+ feet)	Mount April Fm.	Ordovician dolomite unit Mount April Fm.



Nowhere has a complete section of this formation been measured. This is partly due to incomplete exposure but it is also due to the incompetent nature of the beds which are commonly drag folded and faulted.

In the Pine Pass area, the formation averages 2,500 feet thick (Muller, 1961). The thickest section of Mount April reported by Tedrick (1962) from the Prophet River area is 2,121 feet, from the northwestern face of Mount McCusker. In the North Chesterfield Lake section (Plate 1, Figure 1), 2,170 feet of Mount April Formation were measured. Jackson, Steen, and Sykes (1965, page 140) estimate that the total thickness of the Mount April is 4,500 feet and believe that a complete section of the Mount April is exposed on the eastern spur of Lombard Peak, 14 miles east-northeast of Cloudmaker Mountain.

### Lithology

The Mount April Formation consists of argillaceous limestones and calcareous mudstones and shales. The argillaceous content increases westwards. Lime is the dominant constituent in the Halfway River area: clay is the dominant constituent in the Chesterfield Lake area.

In the Chesterfield Lake area, this unit is very distinctive. It is medium dark grey in colour and weathers medium light grey. It is slightly phyllitic and this gives a sheen to the rock. The weathered profile comprises 6-foot units made up of alternating finely laminated mudstone bands, averaging 5 inches thick, and more calcareous nodular bands, averaging 1 inch thick (Plate 1, Figures 2, 3, and Plate II, Figures 4,5). The rocks split at various angles to the bedding.

A few limestone bands and lenses are present. These are generally less than 1 foot thick and contain a "hash" of fossil debris (Plate II, Figures 2,6), most of which is chitinous and a little of which is silicified. No bedding is present in these limestones and their contact with the host mudstone is irregular.





PLATE I

Mount April Formation

Figures:

1. Mount April Formation (foreground) north of Chesterfield Lake (bottom right corner).
- 2,3. Typical weathering habit of Mount April Formation. Note ridged surface reflecting alternating mudstone and harder calcareous mudstone bands.
- 4,5. Argillaceous carbonate unit at the top of the Mount April Formation. Figure 4 shows the resistant nature of the unit and the development of blocky beds in the middle of the unit. Figure 5 shows the laminated habit which persists throughout the unit.

PLATE I.



1

10'  
0



2



3



4



5





PLATE II

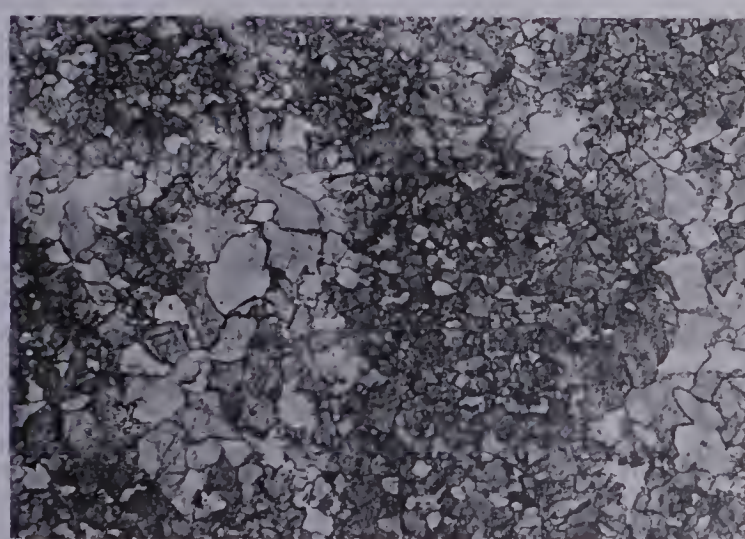
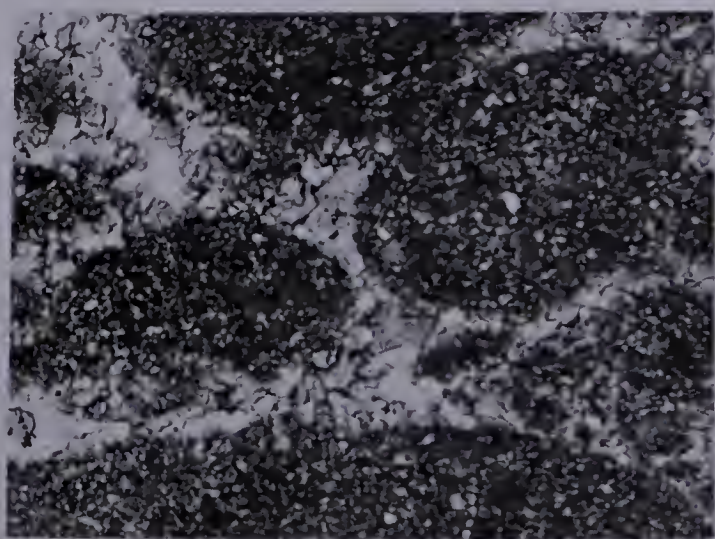
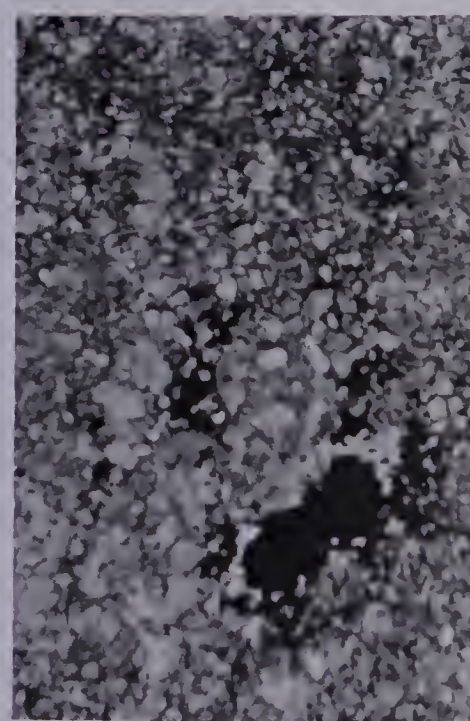
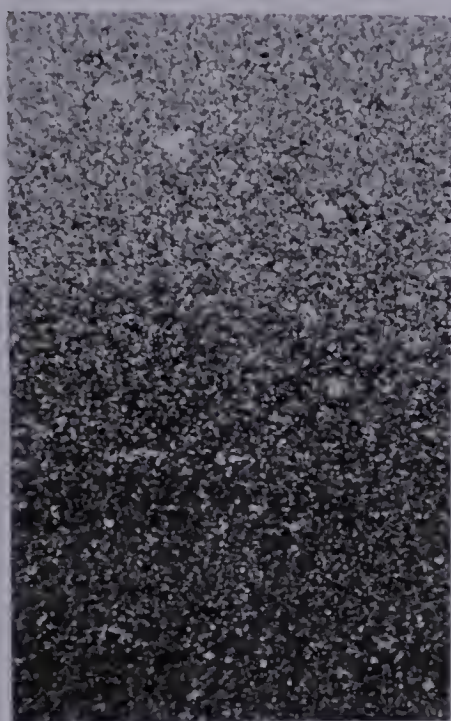
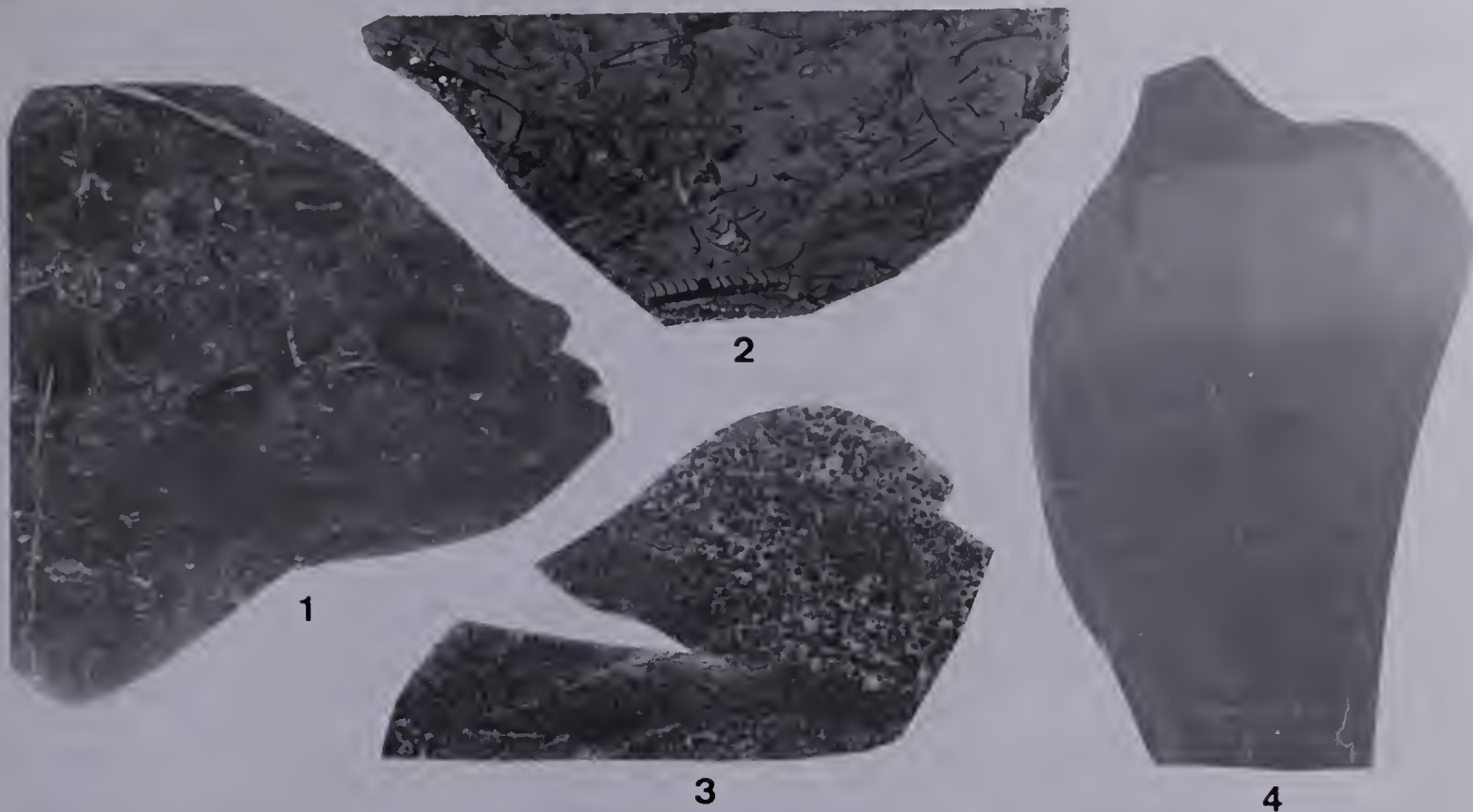
Polished hand specimens (Figures 1-4) and thin sections (Figures 5-9)

(Hand specimens X1, thin sections X25 and all photographed under plain light)

Figures:

- 1,8. Algal dolomite from the Ordovician dolomite unit. Many of the algal balls grow around bioclastic fragments. S 16030.
- 2,6. Fossil "hash" from the Mount April Formation. Note sectioned ellesmerocerids. ED 6439.
- 3,9. Pelletoid dolomite from the Ordovician dolomite unit. The pellets are more finely crystalline than the matrix. ED 65144.
- 4,5. Typical lithology of the Mount April Formation. Note gradational contact between mudstone and calcareous mudstone bands. ED 6425.
- 7. Ordovician dolomite unit sample with "oxidized blebs". S 16144.

PLATE II.





The uppermost part of the Mount April Formation is marked by 135 feet of cliff-forming, argillaceous carbonate (Plate I, Figure 4), the bulk of which is limestone, although dolomite is developed near the top. The typical nodular habit of the Mount April Formation is not developed here but the unit is very finely laminated throughout (Plate I, Figure 5). The laminations reflect variable clay content and result in a yellow and grey colour banding on the weathered surface. Only fragmentary graptolites were found in this unit.

In the Halfway River area, ripple laminated argillaceous limestones are typical and these weather light brownish grey. Bedding is massive and slaty cleavage is well developed. A fauna of trilobites and brachiopods is present but fossils are not common.

### Contacts

The base of the Mount April Formation is exposed on Mount April but the nature of the contact with the underlying Cambrian (?) sandstones and shales is unknown. Irish (1964, page 811) reports probable Middle Cambrian fossils from 900 feet below the top of a possibly correlative unit in the Ospika River area.

The upper contact is not exposed on Mount April but in other sections the Mount April Formation is overlain, probably conformably, by either the Cloudmaker Formation, or the Ordovician dolomite unit. Southwest of Muncho Lake, the Mount April is overlain unconformably by Silurian dolomites (Norford, 1964, page 46) but eastwards the formation is overstepped by the Silurian and it is missing to the east of Muncho Lake.

### Age

All fossil collections from the Mount April Formation are of Canadian age. Fossils from the North Chesterfield Lake and South Sikanni Chief River sections have been studied and, in addition, Irish (1964, page 815) records fossil identifications



from the Halfway River Map-area.

The lower age limit of the formation is not known but it is interesting to note that there are no published reports of definite Upper Cambrian fossils from northeastern British Columbia. The oldest collection in the North Chesterfield Lake section probably represents Zone D of Ross (1951) and Hintze (1952) but from just south of Muncho Lake, Norford (1962c, Plate III, Figure 12) reports Xenostegium sp. This indicates Zone B and it is also possible that this zone is represented in the South Sikanni Chief River section by a trilobite pygidium assigned with qualification to Bellefontia nonius Walcott.

It is probable that the top of the Mount April Formation lies near the top of the Didymograptus protobifidus Zone.

### CLOUDMAKER FORMATION

The Cloudmaker Formation was proposed by Jackson, Steen, and Sykes (1965) for a sequence of graptolitic shales, siltstones, sandstones, and quartzites. The type section is located on the northern slope of Cloudmaker Mountain (57° 46'N, 125° 06'W).

In the Akie River area, the following threefold division of the Cloudmaker Formation can be made (Figure 7):

3. upper shale and siltstone member
2. quartzite member
1. lower shale and siltstone member

### Distribution and thickness

The lower shale and siltstone member can be traced from Cloudmaker Mountain southwards into the Lady Laurier Lake area (Figure 13). Over this distance its thickness is variable: 1,183 feet at the type section; 845 feet north of Akie River; 1,425 feet on the south side of Calnan Creek; and 800 feet south of Lady Laurier



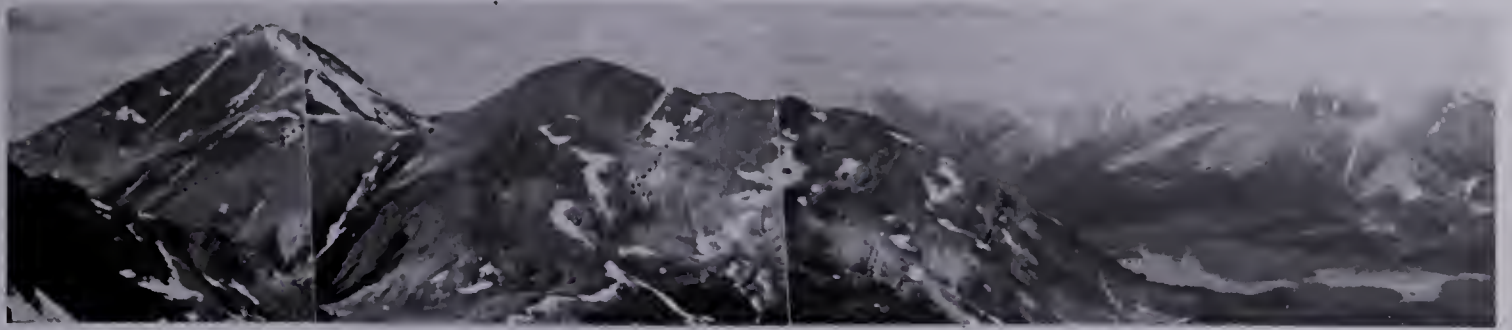


PLATE III  
ORDOVICIAN

Figures:

1. Mount Lady Laurier (left side of panorama) and Lady Laurier Lake. Three dotted lines denote thrust faults. Second thrust from left separates Mount April Formation from Ordovician dolomite unit and dashed line marks contact between latter and Cloudmaker Formation. Mount Lady Laurier shows the very characteristic appearance of the Mount April Formation. The northern part of the South Lady Laurier Lake composite section was measured from the lower limit of exposure to the first thrust fault. Note that the measured section is overturned.
2. Overturned syncline involving lower shale and siltstone member of Cloudmaker Formation and Ordovician dolomite unit. Dashed lines denote contact of units. The twofold division of the Ordovician dolomite unit into a stratigraphically lower light and an upper dark weathering unit is well shown. Near the left margin of the photograph a thrust fault (dotted line) has brought the dark weathering dolomite over the light weathering dolomite. West (left) of the synclinal axis, the entire section is overturned.
3. Contact (shown by arrow) of Ordovician dolomite unit and Cloudmaker Formation at head of Calnan Creek valley. Lower shale and siltstone member was measured here. Sandstones near top of member form resistant hill in background.
4. Ordovician dolomite unit on south side of Calnan Creek. Section measured down east (left) side. Dotted line denotes small fault. West of the fault the basal part of the Cloudmaker Formation is seen.
5. Quartzite member of Cloudmaker Formation on Calnan Creek - Slade Creek divide. Note resistant nature of quartzite and thick graptolitic silty shale interbeds.

# PLATE III.



1



2



3



4



5



Lake. The large thickness of this member at Calnan Creek is surprising because the base is stratigraphically higher than in the more northerly sections. From Calnan Creek to Lady Laurier Lake the lower part of this member passes into dolomite. It is possible that the maximum thickness of the lower shale and siltstone member occurs in the Kwadacha River area where the member contains a large thickness of volcanics (Taylor, 1965, page 66).

The quartzite member can be traced from the Akie River area to the Lady Laurier Lake area and may be correlative with the Ordovician sandstone unit of the Peace River area. This member and the overlying upper shale and siltstone member are missing on Cloudmaker Mountain due to overstep or onlap of the Sandpile Group. The thickness of the quartzite member is fairly constant: between 285 feet and 330 feet in the Akie River area; about 265 feet south of Calnan Creek; and 310 feet south of Lady Laurier Lake.

The upper shale and siltstone member is known only from the Akie River area where its maximum thickness is 85 feet. It is probably present in the Halfway River area but, in the localities studied, strata immediately above the quartzite member are not exposed.

### Lithology

The lower shale and siltstone member is fairly recessive and consists primarily of siltstones and shales but locally sandstones, quartzites, and dolomites are important. The siltstones and shales are typically dark grey and weather medium to dark grey, brownish grey, and bluish grey. The siltstones are commonly laminated. Graptolites are common throughout the member, except where they have been destroyed by metamorphism.

At Calnan Creek, the lower 570 feet of the member consists of calcareous mudstones which are lateral equivalents of dolomites of the Lady Laurier Lake area.





PLATE IV

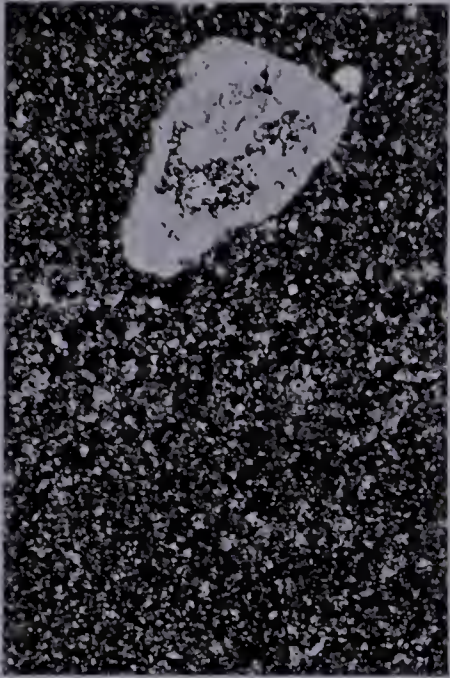
Thin sections (Figures 1, 4-8) and polished hand specimens (Figures 2,3)

(Thin sections X25, hand specimens X1)

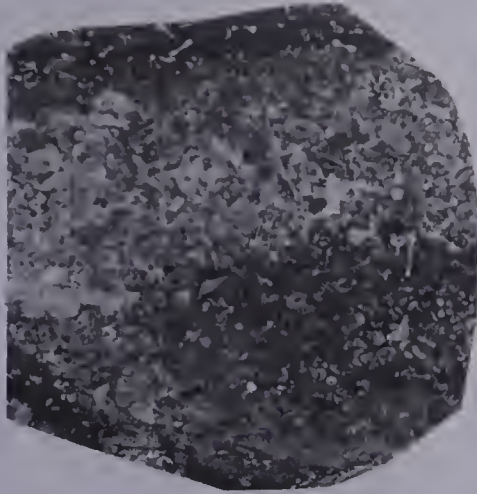
Figures:

1. Silurian (and Ordovician?) mudstone unit. Note fossil partially replaced by silica. ED 65106. Crossed nicols.
2. Encrinite band in Silurian dolomite unit. S 16041.
3. Silurian dolomite unit. Sandy dolomite with lithoclasts. ED 6534.
4. Same specimen as Figure 3. Note well rounded strained quartz grains and corrosion of some grains. Crossed nicols.
5. Quartzite member of Cloudmaker Formation. Note degree of recrystallization. ED 65150. Crossed nicols.
6. Quartzite near base of Silurian siltstone unit. Note rounded strained quartz grains and matrix. ED 6575. Crossed nicols.
7. Sandstone near top of lower shale and siltstone member of Cloudmaker Formation. Note impurity compared with Figure 5. ED 6526. Plain light.
8. Silty, in part laminated, dolomite near base of Silurian (and Ordovician?) dolomite unit. S 16029. Plain light.

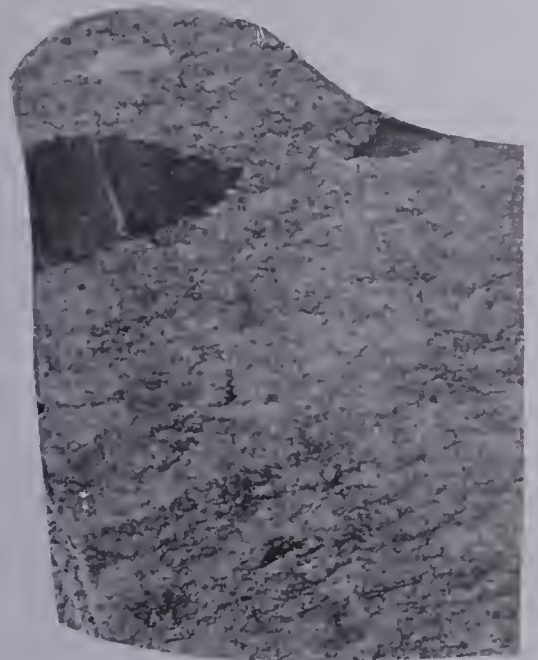
# PLATE IV.



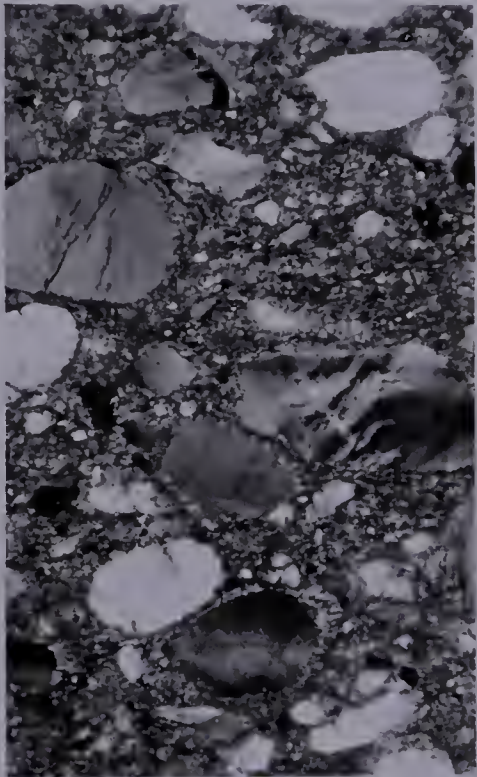
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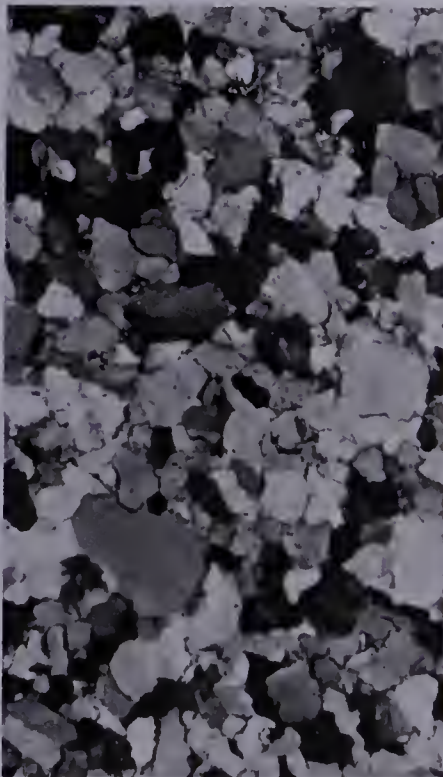
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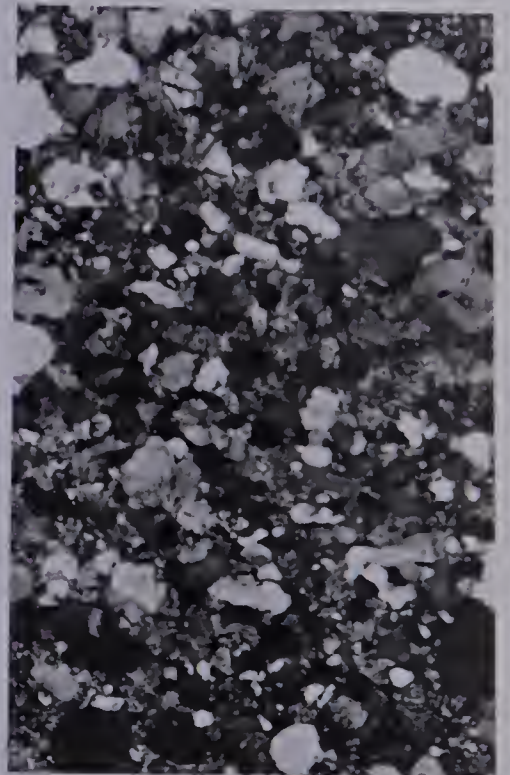
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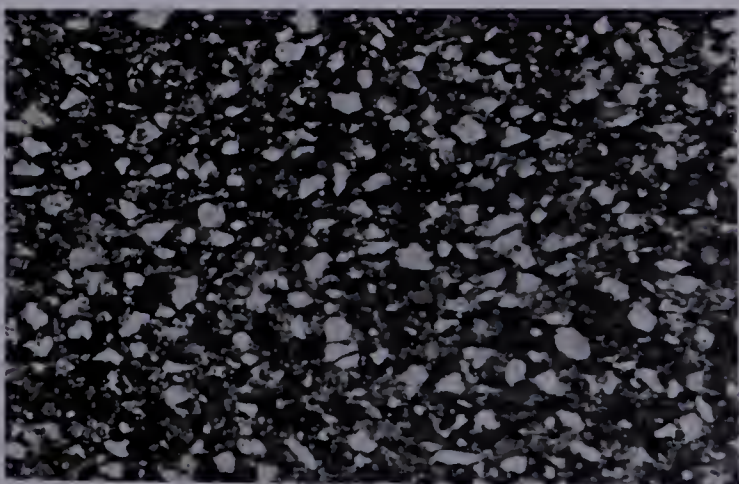
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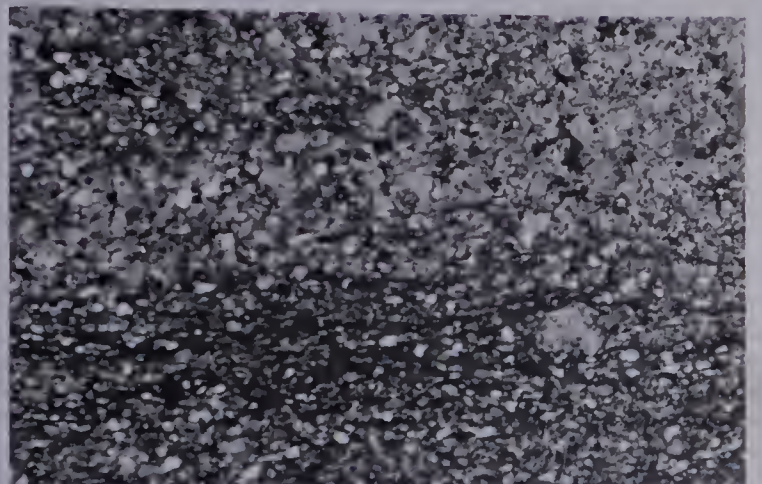
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7



8



In the Akie River and Halfway River areas, sandstones and quartzites are important near the top of the member and the contact with the quartzite member is lithologically not obvious. These sandstones (Plate IV, Figure 7) and quartzites are very fine grained, weather brown, and are thinly bedded. They are interbedded with shales and finely laminated and cross-laminated siltstones.

In the Cloudmaker Mountain area, a cliff-forming dolomite unit is present in the lower part of the member. This dolomite unit is 219 feet thick in the North Chesterfield Lake section but it does contain interbeds of graptolitic siltstone. The dolomite contains abundant lithoclasts and is extensively chertified. Fossils are not common and only a few indeterminate orthid brachiopods were found. This unit seems to be of local occurrence and variation in its thickness is apparent even in "walking the outcrop".

The quartzite member consists of massive, very light grey quartzite which weathers very light grey to yellow grey. In places, a black lichen cover is characteristic. In thin section, the quartzite is seen to be fine grained with variations to coarse grained and to silt size. The grains are almost entirely of strained quartz and many show the effects of corrosion and pressure solution. The cement is siliceous and occasionally also dolomitic in small part (Plate IV, Figure 5). Interbeds of dark, fissile, silty shales are common in the lower part of the member (Plate III, Figure 5) and these yield abundant graptolites.

The upper shale and siltstone member is composed of dark grey silty shales and siltstones with minor argillaceous dolomite. The silty shales yield a rich graptolite fauna.

### Contacts

i) Internal. The lower and upper contacts of the quartzite member are sharp. A hiatus of varying magnitude in different areas, preceding the deposition of the quartzite member, could explain the variation in thickness of the lower shale



and siltstone member.

ii) External. The lower contact of the Cloudmaker Formation with the Mount April Formation or the Ordovician dolomite unit is probably conformable. In the Cloudmaker Mountain area, the Sandpile Group unconformably overlies the lower shale and siltstone member of the Cloudmaker Formation. In the Akie River area, the Sandpile-Cloudmaker contact probably represents a hiatus because the ?zone of Diplograptus modestus is absent. The contact in this area is located only on faunal evidence: the Monograptus cyphus Zone assemblage is easily separated from the Dicellograptus complanatus ornatus Zone assemblage but lithologically the contact is difficult to pick. In the Halfway River area, the upper shale and siltstone member has not been recognized and the external and internal relations of the Silurian (and Ordovician?) mudstone unit are uncertain.

### Age

The oldest graptolite collection in the Cloudmaker Formation is from north of Akie River and represents the Didymograptus protobifidus Zone. In the Halfway River area, the oldest graptolite collections represent the Climacograptus bicornis Zone.

The lower shale and siltstone member ranges up into the Orthograptus truncatus intermedius Zone. Graptolite collections from near the base of the quartzite member are from the Orthograptus truncatus intermedius Zone or the Orthograptus quadrimucronatus Zone.

The upper part of the quartzite member is unfossiliferous (see Figure 14). Graptolite collections from the upper shale and siltstone member are from the Dicellograptus complanatus ornatus Zone.



## ORDOVICIAN DOLOMITE UNIT

This unit consists of resistant dolomites and is easily separated from the limestones of the underlying Mount April Formation. It is completely exposed along a ridge three miles northeast of the summit of Mount Kenny (56° 57'N, 123° 50'W).

### Distribution and thickness

This unit outcrops in the Halfway River area and southwards to the Peace River area. It is also present in the Clearwater Creek section and in the Prophet River area (Tedrick, 1962).

At Mount Kenny this unit is 2,373 feet thick. In the South Calnan Creek section (Plate III, Figure 4) and South Lady Laurier Lake section (Plate III, Figure 1), the unit is faulted and its exact thickness is unknown. It is thinner in the Peace River area (see map in Edmonton Geological Society Fieldbook, 1962). Northwards from Mount Kenny, the Ordovician dolomite unit is truncated beneath the transgressive Silurian and (or) Ordovician sandstone unit and at Mount McCusker its thickness has been reduced to 1,314 feet.

### Lithology

This resistant unit is primarily composed of microcrystalline to very finely crystalline dolomite. It is only slightly silty or argillaceous in part in the Halfway River area, but northwards the unit becomes sandy (Tedrick, 1962). A thin nodular layer of black chert occurs at a similar stratigraphic position in many sections.

Algal dolomite (Plate II, Figures 1, 8) and, to a lesser extent, pelletoid dolomite are well developed. Algae are particularly abundant at certain levels and are characteristic fossils in this unit. The pelletoid dolomite (Plate II, Figures 3, 9) is very distinctive as it weathers light grey with dark grey spots. At some stratigraphic levels, oxidized "blebs" are present in the dolomite (Plate II, Figure 7).

The weathered profile of the Ordovician dolomite unit is typically massive



but it is commonly broken down into thin to medium beds with very irregular bedding planes. In the Halfway River area, a twofold division of the Ordovician dolomite unit based on weathering colour is apparent: the lower part weathers medium grey and it is overlain by 1,050 feet of darker weathering dolomite (Plate III, Figure 2).

Apart from algae, fossils are not common. Present are primitive corals, sponges, brachiopods, gastropods, cephalopods, and echinoderm fragments. Maclurites is the most common gastropod.

#### Contacts

The contact of the Ordovician dolomite unit with the underlying Mount April Formation is exposed on Mount Kenny and is probably conformable. The Ordovician dolomite unit is the lateral equivalent of part of the Cloudmaker Formation and is also overlain conformably by this formation (Plate III, Figures 1,2,3,4).

#### Age

The Ordovician dolomite unit is largely, if not entirely, Middle Ordovician in age. Corals are found about 600 feet above the base of unit in the South Sikanni Chief River section. Collections from south of Gauvreau Creek, which may be from this unit, do contain possible Lower Ordovician fossils, however.

McLearn and Kindle (1950) and Sutherland (1958) recorded this dolomite unit from the Halfway River area. Their age assignment of "Upper Ordovician" based on Maclurites was incorrect because in the South Calnan Creek section (Figure 8) the Ordovician dolomite unit is overlain by strata containing early Caradocian graptolites.

The dolomite unit in the lower shale and siltstone member of the Cloudmaker Formation in the North Chesterfield Lake section correlates to part of the Ordovician dolomite unit.



## ORDOVICIAN OF THE PEACE RIVER AREA

The Ordovician of the Peace River area consists primarily of carbonates.

The following succession is present:

5. Silurian and Ordovician dolomite unit
4. Ordovician sandstone unit
3. Ordovician argillaceous carbonate unit
2. Ordovician dolomite unit
1. Mount April Formation

The Mount April Formation and the Ordovician dolomite unit can be traced from the Halfway River area.

The argillaceous carbonate unit is about 285 feet thick and consists of argillaceous limestones varying to calcareous mudstones which pass upwards into argillaceous or sandy dolomites. This unit is dark grey and contains abundant black chert nodules and stringers. It is very fossiliferous and contains a rich fauna of brachiopods together with gastropods, pelecypods, bryozoans, and echinoderm columnals. The fauna is assigned to the Upper Ordovician (in terms of shelly stages) and correlates very well with the fauna of the Maquoketa Shale of Iowa.

The Ordovician sandstone unit is probably correlative with the quartzite member of the Cloudmaker Formation. Its thickness is between 55 and 110 feet and it consists of very fine to fine grained, thick to massive bedded, sandstone and quartzite.

The Silurian and Ordovician dolomite unit is discussed later. An Ordovician age for the base of this unit is based on the presence of Resserella cf. tersa and Dinorthis sp. in a collection from 100 feet above the base of the unit in the Advance Mountain section.

There is no evidence for any unconformities within the Ordovician in the Peace River area. Further south in the Clearwater Creek section, however, the



Ordovician sandstone unit, which is 157 feet thick, overlies the Ordovician dolomite unit with apparent unconformity.

### SANDPILE GROUP

The Sandpile Group was proposed by Gabrielse (1954) for Upper Ordovician and Lower Silurian resistant, ridge-forming carbonates and sandstones in the McDame area. The standard section of reference is near Sandpile Creek, Cassiar Mountains, and the upper part of the Sandpile Group has been described in some detail by Norford (1962a, page 5). The definition of this group has also been extended by Norford (1962a) and Gabrielse (1963) to include graptolitic siltstones.

Jackson, Steen, and Sykes (1965) referred Silurian siltstones outcropping between Akie River and Cloudmaker Mountain to the Sandpile Group.

### Distribution and thickness

All the Silurian and Richmondian strata in the northern Rocky Mountains may be referred to the Sandpile Group. In the Halfway River area, however, the following three fold division of the Sandpile Group is easily made:

3. Silurian siltstone unit
2. Silurian dolomite unit
1. Silurian (and Ordovician?) mudstone unit

On Cloudmaker Mountain 1,212 feet of Sandpile strata are preserved and north of Akie River the group is more than 815 feet thick (Jackson, Steen, and Sykes, 1965). In the South Calnan Creek section, 2,485 feet of the Sandpile Group are overlain by Devonian dolomites.

### Lithology

On Cloudmaker Mountain, the Sandpile Group consists almost entirely of siltstones. These are commonly cross-laminated and weather light brown to



rust. Apart from worm trails and burrows, fossils are not common and, despite an intensive search, none was found in the upper 1,000 feet of the unit. Graptolites are found near the base of the unit.

The base of the Sandpile in the Cloudmaker Mountain area is drawn at the base of a breccia which contains lithoclasts of siltstone and argillaceous dolomite. A 50 feet thick quartzite unit is also present near the base of the Sandpile (Jackson, Steen, and Sykes, 1965).

In the Akie River area, siltstones still predominate but here the lower 200 feet of the Sandpile consists of poorly exposed argillaceous limestone.

#### Contacts

The Sandpile Group unconformably overlies the Cloudmaker Formation, which it oversteps northwards. It is also possible that onlapping relationships exist within the lower part of the Sandpile (see Figure 14).

The upper contact of the Sandpile Group is not preserved in the eugeosynclinal facies belt in the area of study but in the Halfway River area, the Sandpile Group is overlain, probably unconformably, by Devonian dolomites.

#### Age

The oldest graptolite fauna from the Sandpile siltstones has been found in the Kwadacha River and Akie River areas and is assigned to the Monograptus cyphus Zone. On Cloudmaker Mountain, the oldest zone discovered is that of Monograptus turriculatus (Jackson, Steen, and Sykes, 1965). It is thus possible that the age of the base of the Sandpile decreases northwards.

The youngest collection of graptolites is probably GSC 65988 from about 850 feet above the base of the unit in the Kwadacha River area. This collection contains a species of Cyrtograptus which suggests a Wenlockian rather than Llandoveryan age.



The Sandpile siltstones are correlative with the Silurian dolomite unit and the Silurian siltstone unit of the Halfway River area.

### SILURIAN (AND ORDOVICIAN?) MUDSTONE UNIT

#### Distribution and thickness

This unit is present only in the Halfway River area. Northwards and southwards it passes laterally into dolomite. On the south side of Calnan Creek, this mudstone unit is 655 feet thick (Plate V, Figure 5).

#### Lithology

This unit consists of poorly exposed calcareous and, less commonly, dolomitic mudstone and siltstone. A typical thin section is illustrated (Plate IV, Figure 1). The siltstones are commonly laminated. Intraformational conglomerate and black chert are common in the upper part of the interval and the associated mudstone beds generally contain pyrite. Most of the beds split at angles to the bedding plane. Graptolites are common, though mostly poorly preserved, in the lower part of the unit.

South of Slade Creek this unit is cut by thrust faults and it is slightly metamorphosed. Graptolites are preserved only as shiny streaks but at this locality a small euomphalid gastropod was found.

In the Lady Laurier Lake area, a different facies is exposed which may be regarded as intermediate between the mudstone facies of Calnan Creek and the typical Silurian dolomite facies. It consists of a monotonous sequence of laminated flaggy dolomites which weather light medium grey. Black chert nodules are common at some levels but no fossils were found.





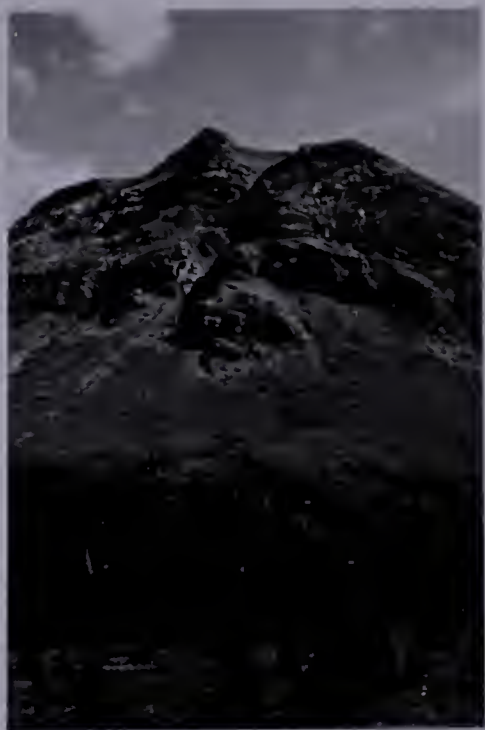
PLATE V

Silurian

Figures:

1. Silurian dolomite unit on south side of Calnan Creek.
2. Silurian dolomite unit, Silurian siltstone unit (measured here), and Devonian dolomite unit on south side of Calnan Creek. Contacts denoted by dashed lines.
3. Silurian dolomite unit on Calnan Creek - Slade Creek divide. Note chert nodules.
4. Silurian dolomite unit south of Lady Laurier Lake. Note abundant argillaceous dolomite lithoclasts.
5. Silurian (and Ordovician?) mudstone unit (measured here), Silurian dolomite unit, and Silurian siltstone unit on Calnan Creek - Slade Creek divide. Contacts denoted by dashed lines.
6. Contact (shown by arrow) between Silurian (and Ordovician?) mudstone unit and Silurian dolomite unit on Calnan Creek - Slade Creek divide. Note interbedding about contact.

PLATE V.



1



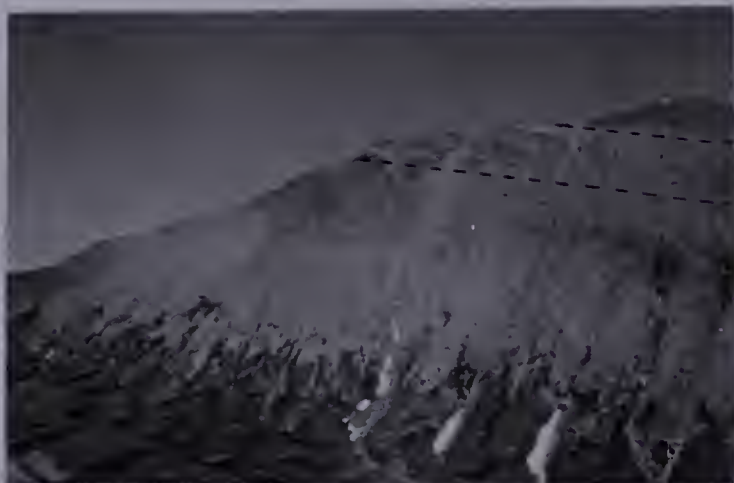
2



3



4



5



6



### Contacts

The lower contact of the mudstone unit with the quartzite member of the Cloudmaker Formation is not exposed in the sections studied and its nature is unknown. The latest Ordovician graptolite zone has not been found but it may be represented by covered strata at the base of the unit.

The upper contact with the Silurian dolomite unit is conformable as evidenced by the lateral equivalence of the units and by some interbedding about the contact (Plate V, Figure 6).

### Age

Collections from this unit south of Calnan Creek are composed entirely of diplograptid graptolites which are assigned to the ?zone of Diplograptus modestus. It is possible, however, that the basal strata, which are very recessive and covered, are Ashgillian.

### SILURIAN (AND ORDOVICIAN IN SOME AREAS) DOLOMITE UNIT

The base of this unit is diachronous. In the Peace River area, the Clearwater Creek section, and in the Prophet River area (Tedrick, 1962), the base of this unit is Late Ordovician in age. A formal name for the Silurian dolomite unit will shortly be available (Norford, Gabrielse, and Taylor, in press).

### Distribution and thickness

This unit can be traced from the Pine Pass area to the Yukon border. In the Peace River area, the Siluro-Ordovician dolomite unit is between 1,485 feet and 1,580 feet thick, the Silurian part of which is probably 1,300 feet to 1,400 feet thick. In the Clearwater Creek section, 837 feet of Siluro-Ordovician dolomite unit is preserved beneath the sub-Devonian unconformity.

South of Calnan Creek, the Silurian dolomite unit is only 367 feet thick



but it thickens very rapidly to perhaps 2,080 feet at Mount Kenny. Just north of Sikanni Chief River its thickness is 1,589 feet.

### Lithology

This cliff-forming unit (Plate V, Figure 1) consists of medium dark grey, micro-crystalline to very finely crystalline dolomite which weathers medium grey. Sandy, silty, or argillaceous dolomite beds are common and some beds are vaguely laminated (Plate IV, Figure 8). The sandy dolomite consists of rounded, up to very coarse, strained quartz grains floating in a dolomite matrix (Plate IV, Figures 3, 4). Some beds, and especially the sandy beds, contain abundant lithoclasts of argillaceous dolomite which are subparallel to the bedding (Plate V, Figure 4). Chert is common, particularly at one stratigraphic level and most fossils are silicified (Plate V, Figure 3). Corals are the dominant fossils but brachiopods are locally important. Encrinite bands are found near the base of the unit (Plate IV, Figure 2).

### Contacts

In the Halfway River area, the Silurian dolomite unit conformably overlies the Silurian (and Ordovician ?) mudstone unit (Plate V, Figure 6). In the Peace River area, the Silurian and Ordovician dolomite unit overlies a sandstone unit and the relationship is probably conformable. In the Sikanni Chief River area, the Silurian (and Ordovician ?) dolomite unit again overlies a sandstone unit which may or may not be correlative with the sandstone unit of Peace River. In the Sikanni Chief River area, this sandstone unit oversteps the Ordovician dolomite unit. Thus it is probably a basal transgressive sandstone and conformable with the overlying dolomite unit.

In the Halfway River area, the Silurian dolomite unit is overlain conformably and gradationally by the Silurian siltstone unit. Elsewhere it is overlain by a light coloured, Devonian dolomite unit (Muncho-McConnell equivalent). The contact is one of regional unconformity but, nevertheless, it is difficult to pick with certainty



in some sections.

The Silurian and Ordovician dolomite unit is in part a facies equivalent of the Silurian (and Ordovician?) mudstone unit and probably in part is also a facies equivalent of part of the Silurian siltstone unit.

### Age

The oldest diagnostic fossil collections from this unit are from Advance Mountain and the Clearwater Creek section and are Richmondian in age. From the Prophet River area, Tedrick (1962, Figure 3) records a Late Ordovician coral fauna. Elsewhere the unit is not proven to be older than Llandoveryan but Upper Ordovician could also be represented in the North Sikanni Chief River section.

The Silurian fossil collections are difficult to date accurately but most of them are probably Late Llandoveryan or Wenlockian. North of Lady Laurier Lake, the Silurian dolomite unit is overlain by siltstones which yield a Late Llandoveryan graptolite fauna.

## SILURIAN SILTSTONE UNIT

### Distribution and thickness

This unit is present in the Halfway River area. South of Calnan Creek it is 1,463 feet thick and this figure is probably a maximum for the area.

### Lithology

This unit consists of dolomitic siltstones which pass upwards into calcareous siltstones. The siltstones are commonly laminated and become sandy towards the top of the unit. Rare beds of dolomite and argillaceous limestone are present and these contain a small fauna of favositid corals and echinoderm columnals. Rare graptolites occur in the lower part of the unit but, despite an intensive search, none was found in the upper 1,000 feet of the unit.



In the South Slade Creek section, a 30-foot quartzite interval, with beds up to four feet thick, is present near the base of the unit (Plate IV, Figure 6). This quartzite development is impersistent, however, and it is insignificant at Calnan Creek. At the top of the quartzite interval, pockets of vuggy dolomite yield a small coral fauna. These dolomite pockets suggest that elsewhere more massive dolomites were being formed contemporaneously.

### Contacts

The lower contact of this unit with the Silurian dolomite unit is conformable and probably diachronous to some extent.

The Silurian siltstone unit is overlain by the light coloured, Devonian dolomite unit. No discordance between the units was observed but regional considerations suggest that the contact is unconformable.

### Age

The oldest graptolite collection from this unit belongs to the Llandoveryan zone of Monograptus spiralis. Younger graptolite collections are poorly preserved but are probably Wenlockian in age.

Excellent specimens of Favosites from near the top of the unit have unfortunately not been identified to species level and probably represent a new species.

The Silurian Siltstone unit is largely correlative with the Sandpile siltstones of the Akie River and Cloudmaker Mountain area.

### ORIGIN OF UNITS

The distribution of rock units in the northern Rocky Mountains indicates that the rocks to the west were deposited in relatively deeper water.

The persistence of ripple laminated beds in the Mount April Formation of the Halfway River area suggests deposition above wave base. In the North Chesterfield



Lake section, however, a deep water origin is suggested for the Mount April Formation by the persistence of fine laminations and by the lesser amount of carbonate. Fossils are only found in irregular "hash" bodies and these probably represent slumps off a carbonate platform. The "hash" bands contain considerably more lime than the calcareous mudstones which comprise the bulk of the succession. The fact that a rich biocoenose was existing elsewhere at the same time further suggests that the Mount April Formation of the Chesterfield Lake area was deposited in deep water.

The overlying lower shale and siltstone member of the Cloudmaker Formation bears evidence to sustained deep water deposition. These graptolitic shales and siltstones yield only a very small benthonic fauna. In the Halfway River and Peace River areas, however, the Mount April Formation is overlain by the Ordovician dolomite unit. This unit was formed in an agitated, shallow-water environment as evidenced by pelletoid dolomite, "algal balls", thick-shelled calcareous benthonic fossils, the abundance of bioclastic debris, and ripple bedding. This unit is much thicker than the correlative part of the Cloudmaker Formation. The presence of oxidized "blebs" may be the record of periodic exposure to sub-aerial conditions. In the Halfway River area, the Ordovician dolomite unit is overlain by graptolitic siltstones and shales and this suggests that deeper water conditions followed.

The quartzite member of the Cloudmaker Formation bears witness to a time of influx of terrigenous clastic material. The interbedding of graptolitic siltstone and quartzite near the base of the unit indicates that this unit may not necessarily have been deposited in very shallow water. No directional sedimentary structures were seen in this unit and thus the source of the quartz sand can only be hypothesized. A northerly source is likely because the quartzite member is not present in the Chesterfield Lake area and this could mean that this area was emergent in late Caradocian times.

The upper shale and siltstone member of the Cloudmaker Formation and the



Silurian (and Ordovician?) mudstone unit may represent the oldest deposits of a transgressive sea. Dolomites were being formed contemporaneously on the eastern platform but it is probable that the Chesterfield Lake area was still emergent. The time of deposition of the Sandpile coralline member was likely one of rapid transgression. Dolomites containing the Sandpile coralline member fauna are widespread in the mixed and platform facies and at about this time it is probable that the Chesterfield Lake area was submerged and that the siltstones with graptolites of the Monograptus turriculatus Zone were deposited. The abundance of corals at some levels in the Silurian dolomite suggests that the dolomite unit was formed in shallow water. The origin of the sand lenses and bands of lithoclasts is unknown but their presence indicate that conditions were not always favourable for coral growth.

The Silurian siltstone unit likely represents continued transgression. This unit contains lenses of dolomite with corals which suggests that platform dolomites were being formed contemporaneously.

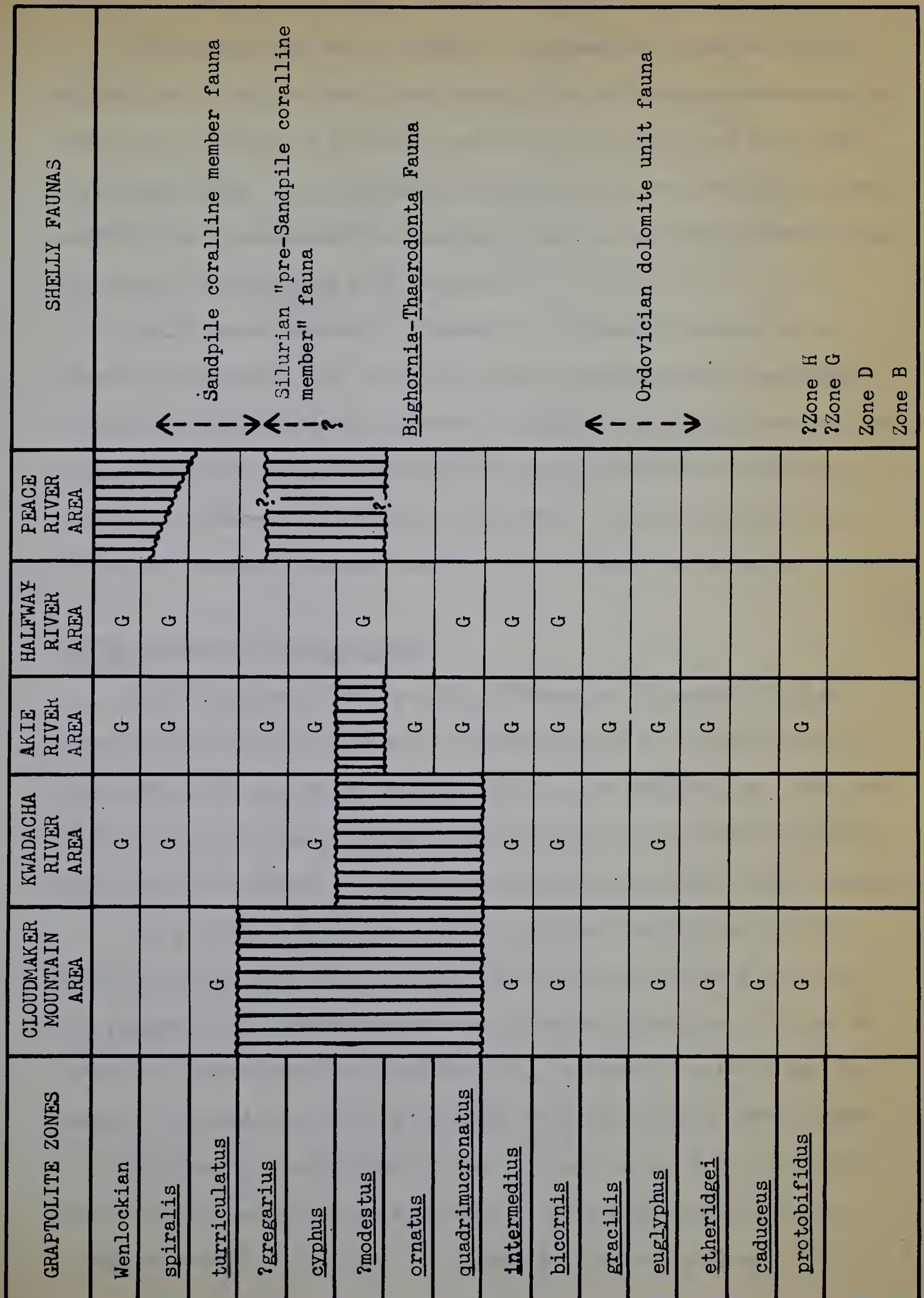
The Devonian dolomite unit of probable Early Devonian age belongs to another cycle of transgression.

### UNCONFORMITIES

The temporal magnitude of the unconformity at or near the Siluro-Ordovician boundary in different locations is shown in Figure 4. It is clear that the placing of this unconformity is difficult since it is not easy to differentiate overstepping from onlapping relationships on the basis of the present data. In theory, a regional unconformity could be present at the base of either the quartzite member of the Cloudmaker Formation, the Silurian (and Ordovician?) mudstone unit, or the Silurian dolomite unit. It is probable, however, that it occurs at or near the base of the Silurian (and Ordovician?) mudstone unit in the Calnan Creek area because, even though this unit is missing in the Akie River area, the contact of



Figure 4. Temporal magnitude of unconformities in northern Rocky Mountains and tentative correlation of shelly faunas with graptolite zones.  
(Vertical lines denote hiatus, G signifies graptolite control)





this unit with the Silurian dolomite unit is one of facies change.

In the Peace River area, available data suggests that strata containing the Sandpile coralline member fauna disconformably overlie Richmondian strata and, on similar faunal evidence, it is probable that this break is also present in the Clearwater Creek Section. In the Clearwater Creek section, another break may separate the Ordovician sandstone unit from underlying dolomites which carry a Whiterockian fauna 14 feet below the base of the sandstone.

The Silurian siltstone unit is overlain in the Halfway River area by the Devonian dolomite unit. The contact is probably unconformable and southwards the temporal magnitude of this unconformity increases. In the Peace River area, the thickness of the Siluro-Ordovician dolomite unit preserved beneath the Devonian dolomite unit is between 1,485 and 1,580 feet thick. This thickness is down to 837 feet at Clearwater Creek and is only 414 feet at Mount Hunter (Norford, 1964).

#### CORRELATION WITH McDAME AREA

The Ordovician and Silurian of the McDame area have been studied in some detail by Gabrielse (1963) and the Silurian fauna of the Sandpile Group in this area has been described by Norford (1962a). In the McDame area, Ordovician and Silurian crop out west of the Rocky Mountain Trench in the Cassiar Mountains and the Liard Plain (Figure 1). Stratigraphic nomenclature is shown Table 1 and Figure 5.

The Kechika Group of known Middle Cambrian, Early Ordovician and Middle Ordovician age overlies the Lower Cambrian Atan Group and faunal evidence suggests that the contact between these groups is conformable. In the southwestern and southern parts of the McDame area, the Kechika consists of argillites whereas in the northeastern and eastern parts, calcareous beds are typical. Graptolitic shales and siltstones of Middle Ordovician age crop out in the Liard Plain. Bodies of greenstone are common in the Kechika but in most cases the rocks are altered and their origin is in doubt. It is clear that the Kechika Group is very



similar to the Mount April Formation with regard to lithology and facies distribution. The upper part of the Kechika Group correlates in part with the lower shale and siltstone member of the Cloudmaker Formation and greenstone is present in this member in the Kwadacha River area.

The Sandpile Group is typically developed in the eastern part of the McDame area and comprises ridge-forming dolomites and sandstones of Late Ordovician and Silurian age. The Sandpile coralline member fauna is widespread in northeastern British Columbia and it is clear that the type Sandpile Group correlates with the Siluro-Ordovician dolomite unit of the northern Rocky Mountains. In the type area, the Sandpile unconformably overlies black slates of the Kechika Group and is overlain unconformably by Middle Devonian carbonates of the McDame Group.

On the limbs of the McDame synclinalorium, the Kechika Group is overlain by 50 feet of laminated dolomites and these are in turn overlain by siltstones which yield monograptids of Late Llandoveryan or Wenlockian age. Thus the Sandpile Group in this area correlates with the Silurian graptolitic siltstones of the northern Rocky Mountains. The siltstones are overlain by sandstones and dolomites of unknown age which are in turn overlain by a Silurian or Devonian unit of dolomite and dolomite breccia which is probably equivalent to the Devonian dolomite unit of the northern Rocky Mountains. The Silurian of both the McDame area and the northern Rocky Mountains contains much sand but the source of this sand is unknown.

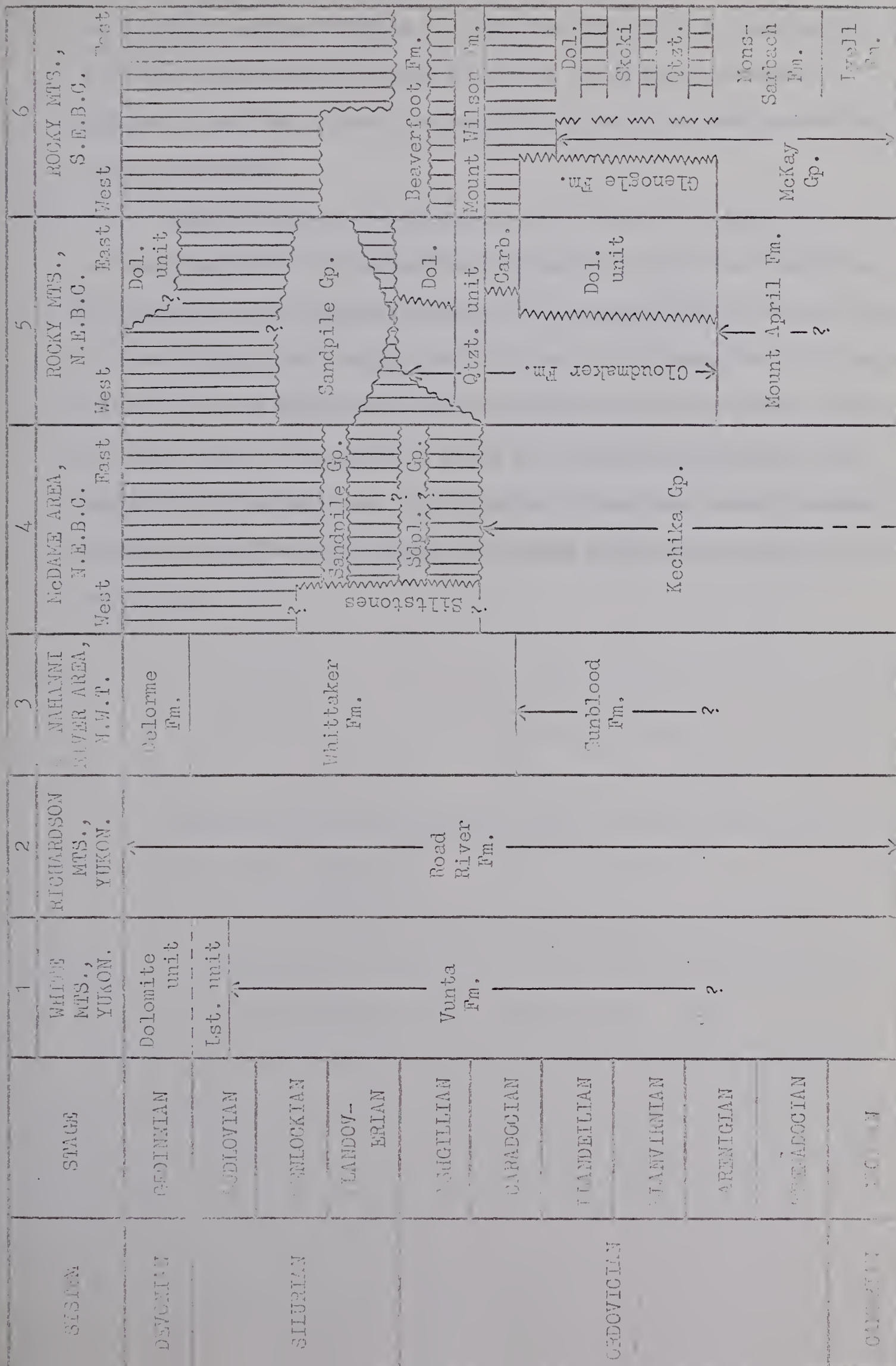
The close correlation between the McDame area and the northern Rocky Mountains indicates that the Rocky Mountain Trench had little effect on sedimentation during Early Paleozoic time.

#### CORRELATION OF THE ORDOVICIAN AND SILURIAN OF THE CORDILLERA AND PALEO GEOGRAPHY

Correlation of Ordovician and Silurian sequences at various locations in



Figure 5. Correlation of Ordovician and Silurian of Cordillera  
(Vertical lines denote hiatus)



4, Reconnaissance of the Ordovician and Silurian rocks of northern British Columbia, 1964; 5 - This study; 6 - Norford, 1964.

3-39; 2 - Jackson and Lenz, 1962; 3 - G' Bertos, E., and Jackson, D., 1964, *Geology of the Northwest Territories*, v. 11, p. 27-32; 4 - Norford, 1964.



the Cordillera is shown in Figure 5. A detailed compilation of the Ordovician and Silurian of western Canada is given by Norford (1964) and, more recently, Jackson (in press) has reviewed the graptolitic facies of the Cordillera and the Arctic Archipelago.

Detailed control on the Ordovician and Silurian of the Cordillera is still far from complete but it is evident that in Ordovician and Silurian times, fine grained clastic rocks were being deposited in an eugeosyncline to the west while platform carbonates were being formed to the east. The eastern limit of the eugeosyncline coincides approximately with the Rocky Mountain Trench but, locally, the linear trend of this boundary is broken by carbonate encroachment, as for example in the McDame area. Unconformities in some areas probably represent periods of emergence and widespread sand bodies probably reflect uplift of the source area.



### CHAPTER III: STRATIGRAPHIC PALEONTOLOGY

Tentative correlation of the graptolite zones and shelly assemblages is shown in Figure 4.

#### GRAPTOLITE ZONATION

The zonal distribution of graptolites is shown in Tables 3 and 4 and the correlation and stratigraphic distribution of graptolite collections is shown in Figure 14.

In this study the word "zone" is used in the sense of Berry (1960, page 7): "a thickness of rock containing an assemblage of species which does not occur in exactly the same combination in beds above or below. Generally one or more species are restricted to a particular zone. Some species occurring in a given zone range into it from the zone below, while other species range through the zone into the zone above. Still other species range through several zones".

In northeastern British Columbia, nine Ordovician and definitely three, but probably five, Silurian graptolite zones are recognized (Table 2). The zonal scheme of Berry (1960) is used for the Ordovician of northeastern British Columbia with two modifications:

i) the Didymograptus protobifidus and D. bifidus Zones of Berry are both referred to the Zone of D. protobifidus.

ii) the zonal designate Glyptograptus cf. teretiusculus is replaced by G. euglyphus. The latter graptolite is rather common in northeastern British Columbia and is used as the zonal designate in Yukon (Jackson and Lenz, 1962).

The Silurian graptolite zones are all Llandoveryan. Wenlockian graptolite collections have been made in northeastern British Columbia but zonation is not possible on the material available. The Llandoveryan zones are essentially those of Jackson and Lenz (1962) with one qualification: the Yukon zonal designates of



Table 2. Graptolite zones in northeastern British Columbia

System	Stage	Zone	Approximate Thickness in feet
SILURIAN	WENLOCKIAN		
	LLANDOVERIAN	<u>Monograptus spiralis</u>	50
		<u>Monograptus turriculatus</u>	125+
		? <u>Monograptus gregarius</u>	50
		<u>Monograptus cyphus</u>	thin
		? <u>Diplograptus modestus</u>	200+
ORDOVICIAN	ASHGILLIAN	<u>Dicellograptus complanatus ornatus</u>	75
	CARADOCIAN	<u>Orthograptus quadrimucronatus</u>	75
		<u>Orthograptus truncatus intermedius</u>	115+
		<u>Climacograptus bicornis</u>	300
		<u>Nemagraptus gracilis</u>	115
	LLANDEILIAN	<u>Glyptograptus euglyphus</u>	108+
	LLANVIRNIAN	<u>Paraglossograptus etheridgei</u>	333
	ARENIGIAN	<u>Isograptus caduceus</u>	60
		<u>Didymograptus protobifidus</u>	

It will be seen from Figure 14 that the graptolite collections are geographically rather dispersed and zonal thicknesses, where given, are only approximate.



Monograptus millepeda and M. sedgewicki and M. convolutus have not been found and rather meagre collections from this biostratigraphical interval in northeastern British Columbia are referred to the ?zone of Monograptus gregarius.

### Ordovician Zones

#### Zone of Didymograptus protobifidus

Only one collection, which is from the Akie River area, is definitely assignable to this zone. Collection GSC 65955 contains Didymograptus columbianus which occurs in the protobifidus Zone in southeastern British Columbia (Jackson, 1964, page 527). Associated with D. columbianus are ?Isograptus sp., Phyllograptus sp., and a robust, horizontal species of Tetragraptus. It is probable that this collection is from the upper part of the protobifidus Zone.

In the Cloudmaker Mountain area, this zone is probably present but graptolites in the collections at hand are poorly preserved. The oldest graptolite collection known from northern British Columbia is recorded by Jackson, Steen, and Sykes (1965, page 152) and contains Didymograptus (narrow extensiform) sp. and Tetragraptus ex gr. quadribrachiatus. This collection is younger than collection ED 649 which is tentatively assigned to trilobite Zone H of Ross (1951) and Hintze (1952). Rigby (1958, page 917) cites Didymograptus artus from trilobite Zone H while Berry (1960, page 7) defines his protobifidus Zone on the first dependent didymograptid (D. protobifidus). Thus, assignment of this collection to the D. protobifidus Zone is probably correct.

#### Zone of Isograptus caduceus

This zone is characterized by large varieties of Isograptus caduceus. In North America, this zone was first used by Kindle and Whittington (1958) for a fauna in the Cow Head Group of western Newfoundland.



Table 3. ZONAL DISTRIBUTION OF GRAPTOLITES IN NORTHEASTERN BRITISH COLUMBIA. PART I: ORDOVICIAN

SOURCE OF DATA:										
	1. This study									
	2. Jackson, Steen, and Sykes (1965)									
	3. Both studies									
	LEGEND:									
	? Graptolite identification queried									
	X? Zonal assignment queried									



Table 3. - continued

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
<u>C. riddellensis</u> Harris - - - - -				X						1
<u>C. cf. spiniferus</u> Ruedemann - - - - -						X	X	X		3
<u>C. cf. tubuliferus</u> Lapworth - - - - -							X			1
<u>C. cf. typicalis</u> J. Hall - - - - -							X	X		1
<u>C. sp.</u> - - - - -			X?	X	X	X	X	X	X	3
<u>Cryptograptus antennarius</u> (J. Hall) - - - - -			X							1
<u>C. cf. hopkinsoni</u> (Nicholson) - - - - -			X							2
<u>C. schaeferi</u> (Lapworth) - - - - -			X							2
<u>C. tricornis</u> (Carruthers) - - - - -					X					1
<u>C. sp. A</u> - - - - -			X							1
<u>C. sp.</u> - - - - -			X	X						1
<u>Dicellograptus complanatus</u> Lapworth - - - - -									X	1
<u>D. complanatus ornatus</u> Elles and Wood - - - - -									X	2
<u>D. elegans</u> Carruthers - - - - -							X			1
<u>D. forchammeri</u> (Geinitz) - - - - -					cf.		X			1
<u>D. cf. forchammeri flexuosus</u> Lapworth - - - - -								X		1
<u>D. gurleyi</u> Lapworth - - - - -					X		cf.	cf.		1
<u>D. cf. johnstrupi</u> Hadding - - - - -							X	X		3
<u>D. cf. morrisoni</u> Hopkinson - - - - -							X	X		3
<u>D. sp. A</u> - - - - -							X			1
<u>D. sp.</u> - - - - -					X	X	X	X		3
<u>Dichograptus cf. marathensis</u> Berry - - - - -		X								1
<u>D. cf. octobrachiatus</u> (J. Hall) - - - - -		X								1
<u>D. sp.</u> - - - - -		X	X							3



Table 3. - continued

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
<i>Dicranograptus contortus</i> Ruedemann - - - -						X				3
<i>D. cf. hians</i> T.S. Hall - - - -							X			2
<i>D. kirki</i> Ruedemann - - - -							cf.	X		1
<i>D. nicholsoni</i> Hopkinson - - - -						X				1
<i>D. cf. nicholsoni</i> diapson Gurley - - - -						X				2
<i>D. nicholsoni geniculatus</i> Ruedemann and Decker - - - -						X				1
<i>D. cf. ramosus longicaulis</i> Elles and Wood - - - -						X				3
<i>D. sp.</i> - - - -						X	X	X		3
<i>Didymograptus columbianus</i> Ruedemann - - - -	X									1
<i>D. dubitatus</i> Harris and Thomas - - - -			X							2
<i>D. euodus</i> Lapworth - - - -			X							1
<i>D. aff. extensus</i> (J. Hall) - - - -		X								1
<i>D. aff. nitidus</i> (J. Hall) - - - -		X								1
<i>D. procumbens</i> T.S. Hall - - - -		X								1
? <i>D. robustus</i> Ekstrom - - - -			X							1
<i>D. serratus</i> (J. Hall) - - - -			X?							1
? <i>D. spinosus</i> Ruedemann - - - -			X							2
<i>D. aff. v-deflexus</i> Harris - - - -			X?							2
<i>D. sp.</i> - - - -	X	X	X							3
<i>Diplograptus crassitestus</i> Ruedemann - - - -									X	3
<i>D. decoratus</i> (Harris and Thomas) - - - -			X?							2
? <i>D. ingens</i> T.S. Hall - - - -						X				3
<i>D. multident compactus</i> Lapworth - - - -								X		1
? <i>D. sp.</i> - - - -			X?							2
<i>Glossograptus cf. acanthus</i> Elles and Wood - - - -			X							2
<i>G. hincksii</i> (Hopkinson) - - - -			aff.	X						1
<i>G. sp.</i> - - - -			X	X		X				3



Table 3. - continued

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
<u>Glyptograptus euglyphus</u> (Lapworth) - - - -			X	X	X					3
<u>G. cf. euglyphus major</u> Ruedemann - - - -				X						1
<u>G. cf. sinodontatus</u> Mu and Lee - - - -		?	X							2
<u>G. tereiusculus</u> (Hisinger) - - - -			X	cf.	cf.					1
<u>G. sp.</u> - - - -			X	X		X				3
? <u>Hallograptus mucronatus</u> (J. Hall) - - - -						X				2
? <u>H. sp.</u> - - - -						X				2
<u>Isograptus caduceus divergens</u> Harris - - - -		X								1
<u>I. caduceus maximo-divergens</u> Harris - - - -		X								3
<u>I. cf. caduceus nanus</u> Ruedemann - - - -			X							1
<u>I. forcipiformis</u> (Ruedemann) - - - -			X							3
<u>I. aff. ovatus</u> (T.S. Hall) - - - -			X?							1
<u>I. sp. A</u> - - - -		X								1
<u>I. sp. B</u> - - - -		X								1
<u>I. sp.</u> - - - -	?	X			?					3
<u>Leptograptus flaccidus</u> (J. Hall) - - - -							X			1
<u>L. flaccidus macer</u> Elles and Wood - - - -								X		3
<u>L. sp.</u> - - - -					X	X	X	X		3
? <u>Nemagraptus gracilis</u> (J. Hall) - - - -					X					1
? <u>N. sp.</u> - - - -						X				1
<u>Orthograptus calcaratus</u> (Lapworth) - - - -							X			2
<u>O. calcaratus acutus</u> Elles and Wood - - - -						X				1
<u>O. calcaratus cf. basilicus</u> Elles and Wood - - - -							X	X		1
<u>O. ex gr. calcaratus</u> - - - -							X	X	X	1
<u>O. quadrimucronatus</u> (J. Hall) - - - -							cf.	X		3



Table 3. - continued

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
<u>O. quadrimucronatus inequspinosus</u> Ruedemann							X			1
<u>O. quadrimucronatus spinigerus</u> (Lapworth)							cf.	X		3
<u>O. ex gr. quadrimucronatus</u>							X	X		1
<u>O. truncatus abbreviatus</u> Elles and Wood									X	1
<u>O. truncatus intermedius</u> Elles and Wood							X	cf.		3
<u>O. truncatus pauperatus</u> Elles and Wood							X	X		1
<u>O. truncatus</u> cf. <u>var. strigosus</u> Ross and Berry							X			1
<u>O. ex gr. truncatus</u>							X	X		1
<u>O. whitfieldi</u> (J. Hall)						X		aff.		3
<u>O. sp.</u>						X	X	X		3
<u>Paraglossograptus etheridgei</u> (Harris)			X							1
<u>Phyllograptus</u> aff. <u>angustifolius</u> J. Hall		X								1
<u>P. nobilis</u> Harris and Keble				X						1
<u>P. sp.</u>	X		?							3
<u>Plegmatograptus</u> sp.							X	X		3
? <u>Pseudodichograptus confertus</u> Chu			X							1
<u>Pterograptus sinicus</u> Mu			X							1
<u>Retiograptus geinitzianus</u> J. Hall				X						1
<u>R. cf. pulcherrimus</u> Keble and Harris							X			1
<u>R. sp.</u>							X			1



Table 3. - continued

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
<u>Tetragnathus bigsbyi</u> var. <u>latus</u> Hsu - - - -			X							1
<u>T. ex gr. bigsbyi</u> - - - -			X							1
<u>T. aff. pendens</u> Elles - - - -			X							1
<u>T. ex gr. quadribrachiatum</u> - - - -	X									2
<u>T. sp.</u> - - - -	X	X	X							3
<u>Trigonognathus ensiformis</u> (J. Hall) - - - -		X	X							3
? <u>T. sp.</u> - - - -			X							1



In northeastern British Columbia, this zone is known only from the Cloud-maker Mountain area where it is at least 60 feet thick but probably not much thicker. The absence of graptolites indicative of this zone in the Akie River area may simply be due to collection failure but available data does suggest that this zone may be absent or very thin (see Figure 14).

In the North Chesterfield Lake section, prolific graptolite specimens are found in this zone even though the number of species is not great. Of more than 1,000 specimens collected, the generic breakdown is as follows: Didymograptus 87.6%; Isograptus 10%; Dichograptus 1%; Phyllograptus 1%; Tetragraptus and Trigonograptus 2 specimens (0.2%) of each. Four species of Didymograptus are present. Only D. procumbens is positively identified but this species has a long range in Australia and is thus not too helpful for dating. The varieties of Isograptus caduceus were not satisfactorily described by Harris (1933). In this study, maximodivergens has been applied to robust types in which the stipe thickens fairly rapidly from the proximal end and divergens has been applied to the large but less robust forms which have a fairly constant width of stipe throughout. Two small species or varieties of Isograptus which do not seem to be immature specimens of these two varieties of I. caduceus have been identified as I. sp. A and I. sp. B. The proportion of large isograptids to small isograptids is higher in the lower of the two intervals sampled.

Two biserial graptolite genera appear in this zone but are quantitatively very insignificant. Trigonograptus ensiformis is present and Trigonograptus cf. ensiformis is recorded from this zone in western Newfoundland by Kindle and Whittington (1958, page 326). Jackson, Steen, and Sykes (1965, page 147) record ?Glyptograptus sinodontatus from this zone.



Zone of Paraglossograptus etheridgei

This zone contains a rich fauna of biserial and dichograptid graptolites. It is well developed in the Cloudmaker Mountain and Akie River areas and is at least 333 feet thick in the North Chesterfield Lake section.

In collection ED 6467 from north of Chesterfield Lake, the zonal designate is present together with species of the other biserial genera Amplexograptus, Cryptograptus, Glossograptus, Glyptograptus, and ?Trigonograptus. Dichograptids are represented by the genera Dichograptus, Didymograptus, Isograptus, and Tetragraptus. This collection is from near the base of the zone but already biserial graptolites outnumber dichograptid graptolites. Poorly preserved holmograptids are also present. The youngest collection from this zone in the North Chesterfield Lake section contains Isograptus forcipiformis which is a good index fossil for this zone.

Collection GSC 65975 from north of Akie River contains a rich fauna including Didymograptus serratulus, Isograptus aff. ovatus, Pterograptus sinicus, and species of the biserial genera Climacograptus, Cryptograptus, Glossograptus, and Glyptograptus. Assignment to the etheridgei Zone is probably correct but the stratigraphic position suggests that the collection is from near the top of this zone. It is interesting to note that an association of Glossograptus hincksii, Pterograptus lyricus, and Isograptus ovatus is found in the basal part of the Glyptograptus teretiusculus Zone in Australia (Thomas, 1960, page 10). Pterograptus sinicus has previously been recorded only from the Llanvirnian of China but abundant specimens are present in this collection. From another section in the Akie River area, Jackson, Steen, and Sykes (1965, page 147) record Diplograptus decoratus from this zone. On stratigraphic position, the collection in which Diplograptus decoratus is present seems to be from a low horizon in the etheridgei Zone. The occurrence of Diplograptus decoratus at the top of the etheridgei Zone elsewhere introduces an anomaly which can only be resolved by further field work. Further detailed collecting at the same time will undoubtedly



result in the subdivision of this zone.

#### Zone of Glyptograptus euglyphus

This zone is characterized by a relative abundance of Glyptograptus euglyphus, or species close to G. euglyphus, and a scarcity of dichograptids.

The best representation of this zone is in the South Kwadacha River section 2 where the zone is at least 108 feet thick. Elsewhere the zone is probably thinner.

In collections GSC 66000, GSC 65983, and GSC 66015 from south of Kwadacha River, biserial graptolites are dominant but fragmentary dendroids and dichograptids are also present. Glyptograptus euglyphus itself is present in collection GSC 66000 together with Climacograptus riddellensis. The latter species occurs in the Glyptograptus teretiusculus Zone in Australia (Thomas, 1960, page 11) and in the G. cf. teretiusculus and Nemagraptus gracilis Zones in Texas (Berry, 1960, page 25). Retiograptus geinitzianus is present in collection GSC 66015. This species is characteristic of the Caradocian and is typically associated with a leptograptid fauna but this is not the case in the collection at hand. Retiograptus geinitzianus does occur in the Llandeilian of Australia, however, and its presence suggests that collection GSC 66015 is from near the top of the euglyphus Zone.

In the South Akie River section, collection GSC 65972 is assigned with confidence to this zone owing to the presence of Phyllograptus nobilis in association with Glyptograptus cf. euglyphus, G. teretiusculus, and other biserial graptolites. Phyllograptus nobilis occurs in the Glyptograptus cf. teretiusculus Zone in Texas (Berry, 1960, page 22).

#### Zone of Nemagraptus gracilis

This zone is recognized all over the world and its base is defined on the incoming of the leptograptid fauna.

Two collections which are from different sections in the Akie River area,



are assigned to this zone. The thickness of this zone is uncertain but it could be as much as 115 feet.

Collection GSC 65977 contains a graptolite with secondary branches which is probably Nemagraptus gracilis itself. Associated are Cryptograptus tricornis, Glyptograptus euglyphus, Climacograptus sp., Dicellograptus sp., and an undetermined and probably new species of Leptograptus which also occurs in the gracilis Zone in southeastern British Columbia (Jackson, oral communication, 1966).

It is possible that a manubriate isograptid is present in this collection (Plate VIII, Figure 23). The specimen is poorly preserved but if the identification were positive it would represent the youngest known occurrence of Isograptus.

Collection GSC 65948 contains poorly preserved graptolites but the association of Dicellograptus with Glyptograptus cf. teretiusculus in the absence of younger Caradocian elements supports assignment of this collection to the gracilis Zone.

#### Zone of Climacograptus bicornis

The base of this zone is marked by the incoming of Climacograptus bicornis and possibly in northeastern British Columbia by the incoming of the genera Dicranograptus and Orthograptus. Climacograptus bicornis itself ranges into the zone above but a form with long, stiff spines inclined at a large angle to the stipe axis is confined to the bicornis Zone.

This zone is represented by several collections and can be recognized from the Cloudmaker Mountain area through to the Lady Laurier Lake area. The zone is about 175 feet thick in the Akie River area but probably thickens to about 300 feet northwards and southwards into the Cloudmaker Mountain area and Calnan Creek area respectively.

Orthograptus calcaratus acutus occurs in great abundance with Climacograptus bicornis in the South Calnan Creek section. This variety is also present in collections



from the Akie River area and is a good zonal index. It is also confined to the bicornis Zone in Texas (Berry, 1960, page 25). Orthograptus whitfieldi, a very broad diplograptid which is probably Diplograptus ingens, Dicranograptus contortus, and Dicranograptus nicholsoni and its varieties also seem to be good zonal indices.

Collection GSC 65953 from north of Akie River contains a rich fauna including Climacograptus bicornis and its varieties peltifer and longispina, Dicranograptus nicholsoni, Glossograptus sp., and Orthograptus calcaratus acutus. With the exception of Climacograptus bicornis longispina, which occurs in the highest Ordovician zone in the Great Basin (Ross and Berry, 1963, page 118), the entire assemblage seems indicative of the bicornis Zone. However, Orthograptus cf. truncatus intermedius is also present in this collection and orthograptids of truncatus type make their appearance in the overlying zone elsewhere in the world. It is thus very probable that the bicornis Zone - intermedius Zone boundary lies within the 2 1/2 feet of section through which this collection was made.

#### Zone of Orthograptus truncatus intermedius

The base of this zone is defined on the incoming of orthograptids of truncatus type. Varieties of Orthograptus quadrimucronatus make their first appearance in this zone too.

This zone is recognized from the Cloudmaker Mountain area through to the Lady Laurier Lake area. In the Akie River area the zone is about 120 feet thick. In the Cloudmaker Mountain area the zone is subjacent to the sub-Sandpile unconformity and is about 85 feet thick. In the intervening area, the zone is probably at least 115 feet thick but the thickness could be three times this amount. A similar situation exists in the South Calnan Creek section: the zone is known to be at least 75 feet thick but 545 feet of overlying strata in which no diagnostic graptolites were found, were measured before encountering graptolites diagnostic of the Orthograptus quadrimucronatus Zone.



The best index is the zonal designate.

Zone of Orthograptus quadrimucronatus

The base of this zone is characterized by the incoming of Orthograptus quadrimucronatus. This ubiquitous species was first used as a zonal designate in North America by Ruedeman in 1904.

In northeastern British Columbia, it is not always easy to differentiate this zone from the underlying one, particularly if the zonal designates are absent. There also appears to be a not inconsiderable mixing of species at the boundary between the two zones and it is clear that further detailed research is required on this part of the section.

Graptolites of the quadrimucronatus Zone are found in shale beds near the base of the quartzite member of the Cloudmaker Formation. Collections range through 75 feet of strata above which come 150 to 200 feet of unfossiliferous, massive quartzites. The zone can be recognized from the Akie River area through to the Lady Laurier Lake area. It is not present in the Cloudmaker Mountain area owing to the sub-Sandpile unconformity.

Apart from the zonal designate, indices tentatively proposed are Leptograptus flaccidus macer and Climacograptus caudatus.

Zone of Dicellograptus complanatus ornatus

This zone is characterized by Dicellograptus complanatus and its variety ornatus. In this study, the zone has only been recognized in the Akie River area where it is about 75 feet thick.

Other easily recognized indices for this zone are Climacograptus hastatus and C. innotatus pacificus. Orthograptus truncatus abbreviatus is the most abundant orthograptid. It was found that all species from this zone are confined to it and it is also worthy of note that Dicranograptus is not present in this zone in Texas or western Canada.



## Silurian Zones

### ?Zone of Diplograptus modestus

In the South Calnan Creek section, six graptolite collections from talus were made in a mudstone unit lying between the quartzite member of the Cloudmaker Formation and the Silurian dolomite unit. None of the graptolites has been positively identified and it is probable that undescribed species or varieties are present.

The lower two collections contain abundant specimens of a small glyptograptid with acuminate thecae which is identified as Glyptograptus cf. tamariscus and a more robust species identified as Diplograptus aff. modestus. A species of Climacograptus close to medius is also present.

The next higher two collections contain climacograptids of scalaris type.

Collection ED 6597 contains one specimen of a diplograptid with orthograptid thecae (Plate XI, Figure 2). The proximal end is not seen but in all other features it exactly matches Orthograptus vesiculosus penna. The highest collection contains Climacograptus sp. indet. and ?Glyptograptus sp.

Owing to the complete absence of monograptids it is clear that a zone older than that of Monograptus cyphus is present.

In Australia, Glyptograptus tamariscus and climacograptids of scalaris type straddle the Siluro-Ordovician boundary (Thomas, 1960, page 19) and, in Britain, Davies (1929, page 1) describes a Diplograptus of modestus type from the Ordovician.

Thus while the fauna suggests an Early Silurian age it could be very late Ordovician. The absence of Dicellograptus is of doubtful significance because this genus may disappear before the systemic boundary is reached.

The graptolite identified as ?Orthograptus vesiculosus penna is felt to strongly indicate Silurian. In addition, Jackson and Lenz (1962, page 41) record Diplograptus modestus and Glyptograptus tamariscus var. from the Diplograptus modestus Zone in Yukon. It is most convenient to refer to the entire assemblage at



Table 4. ZONAL DISTRIBUTION OF GRAPTOLITES IN NORTHEASTERN BRITISH COLUMBIA. PART 2: SILURIAN

SOURCE OF DATA :	ZONAL DISTRIBUTION						SOURCE OF DATA
	(a) ? <u>Diplograptus modestus</u> Zone	(b) <u>Monograptus cyphus</u> Zone	(c) ? <u>Monograptus gregarius</u> Zone	(d) <u>Monograptus turriculatus</u> Zone	(e) <u>Monograptus spiralis</u> Zone	(f) POST - LLANDOVERIAN	(g)
1. This study.							
2. Jackson, Steen, and Sykes (1965).							
3. Both studies.							
LEGEND:							
? Graptolite identification queried							
X? Zonal assignment queried							
? <u>Barrandeograptus</u> sp. - - - - -					X		1
<u>Climacograptus</u> cf. <u>medius</u> Tornquist - - - - -	X	X					1
<u>C.</u> cf. <u>scalaris normalis</u> Lapworth - - - - -	X						1
<u>C.</u> ex gr. <u>scalaris</u> - - - - -	X	X					1
<u>C.</u> cf. <u>tangshanensis linearis</u> Packham - - - - -			X				2
<u>C.</u> sp. - - - - -	X	X	X		X		1
<u>Cyrtograptus</u> cf. <u>lapworthi</u> Tullberg - - - - -					X		1
<u>C.</u> sp. - - - - -						X	1
<u>Dictyonema</u> sp. - - - - -					X		1
<u>Dimorphograptus confertus swanstoni</u> (Lapworth) - - - - -		X					1
<u>D.</u> sp. - - - - -		X	?				3
<u>Diplograptus</u> aff. <u>modestus</u> Lapworth - - - - -	X						1
<u>D.</u> sp. A - - - - -		X					1
<u>D.</u> sp. - - - - -		X					1



Table 4. - continued

	(a)	(b)	(c)	(d)	(e)	(f)	(g)
<u>Glyptograptus</u> cf. <u>persculptus</u> Salter		X					1
<u>G.</u> cf. <u>tamariscus</u> (Nicholson)	X						1
<u>G.</u> sp.	?	X	X				3
<u>Monograptus</u> cf. <u>acinaces</u> Tornquist			X				1
<u>M.</u> <u>concinus</u> Lapworth			X				1
<u>M.</u> cf. <u>dubius</u> (Suess)						X	1
<u>M.</u> cf. <u>exiguus</u> (Nicholson)				X			2
<u>M.</u> cf. <u>gregarius</u> Lapworth		X	X				3
<u>M.</u> cf. <u>halli</u> (Barrande)				X			2
<u>M.</u> cf. <u>proteus</u> (Barrande)				X			2
<u>M.</u> <u>priodon</u> (Bronn)					X	X	1
<u>M.</u> ex gr. <u>priodon</u>				X	X	X	3
<u>M.</u> cf. <u>sardous</u> Gortani						X	1
<u>M.</u> cf. <u>spiralis</u> (Geinitz)					X		1
<u>M.</u> cf. <u>turriculatus</u> (Barrande)				X			2
<u>M.</u> <u>turriculatus</u> minor Bouček				X			2
<u>M.</u> ex gr. <u>vomerinus</u>				X		X	3
<u>M.</u> sp.			X	X	X	X	3
<u>Orthograptus</u> <u>vesiculosus</u> (Nicholson)		X					1
? <u>O.</u> <u>vesiculosus</u> penna (Hopkinson)	X						1
<u>Retiolites</u> <u>geinitzianus</u> (Barrande)					X?		1



hand as belonging to the ?zone of Diplograptus modestus. The assemblage is clearly younger than that found in the ornatus Zone in the Akie River area and it will be very interesting to find out if the latter fauna is present in covered, recessive beds at the base of this mudstone unit in the Calnan Creek area.

#### Zone of Monograptus cyphus

In northeastern British Columbia, the base of this zone is defined on the incoming of monograptids. These early monograptids are associated with a rich fauna of diplograptids and Dimorphograptus. This zone was defined in the same sense in Yukon by Jackson and Lenz (1962).

Three good collections from this zone were studied, two of which are from talus. It is probable that the zone is very thin. Collection GSC 65961 contains a mixture of ornatus and cyphus Zone graptolites which suggests that the cyphus Zone directly overlies the sub-Sandpile unconformity in the Akie River area. The zone is also present in the Kwadacha River area but is possibly absent, due to the onlap of younger zones, in the Cloudmaker Mountain area.

The monograptids have gently curved rhabdosomes with simple thecae. Monograptus concinnus is present in collection GSC 65963 from the Kwadacha River area: this is the earliest monograptid found in Australia (Thomas, 1960, page 13). Dimorphograptus confertus swanstoni is very common in this zone in the Akie River area and a large, new species of Diplograptus is common in all three collections. Collection GSC65961 contains as association of Glyptograptus cf. persculptus, Diplograptus sp. A, and Orthograptus vesiculosus with monograptids. This association was contemporaneous: all specimens occur on the same bedding surfaces.

#### ?Zone of Monograptus gregarius

In the Akie River area, a small collection containing Monograptus cf. gregarius may be correlated with two collections studied by Jackson, Steen, and Sykes



(1965) from the same stratigraphic level in the same area. The assemblages are not definitive and are referred to this zone with reservation.

A triangulate monograptid is possibly present in collection GSC 66017.

#### Zone of Monograptus turriculatus

This zone is only known from the Cloudmaker Mountain area where it was recorded by Jackson, Steen, and Sykes (1965). The zone is probably at least 125 feet thick in this area and yields a fairly rich fauna which includes Monograptus cf. exiguus, M. cf. halli, M. cf. proteus, M. cf. turriculatus, and M. turriculatus minor.

#### Zone of Monograptus spiralis

This zone is known from the Kwadacha River area through to the Lady Laurier Lake area. Its thickness is unknown but is probably less than 100 feet.

In the Kwadacha River area, collection GSC 66017 includes Monograptus cf. spiralis and Retiolites geinitzianus. This association occurs in the spiralis Zone in Yukon (Jackson and Lenz, 1962, page 42).

In the Akie River area, collection GSC 65976 contains Cyrtograptus cf. lapworthi. C. lapworthi occurs in the Late Llandoveryan of Central Europe.

North of Lady Laurier Lake, a collection from just above the top of the Silurian dolomite unit includes Monograptus cf. spiralis and cyrtograptid with numerous cladia which is probably Barrandeograptus.

#### Post-Llandoveryan graptolites

A total of seven post-Llandoveryan graptolite collections were studied, and in addition, collection S 15416 from the Akie River area may belong to the spiralis Zone or be Wenlockian in age.

Of the seven post-Llandoveryan collections, two are very poor. Of the



remainder, collections S 21104 from the South Calnan Creek section and GSC 65960 from south of Akie River are probably correlative. The latter collection contains Monograptus cf. dubius and M. priodon. The stratigraphic position of these collections strongly suggests a Wenlockian age.

Collection GSC 65946 from south of the headwaters of Paul River is probably Wenlockian on the basis of ?Cyrtograptus sp. and Monograptus cf. sardous.

In the Kwadacha River area, two post-Llandoveryan collections were made. The upper one is from 872 feet above a cyphus Zone assemblage and contains what is probably a Wenlockian species of Cyrtograptus. If there are no structural complications in this section, it is possible that the Wenlockian section in this area is as much as 600 feet thick.

Lyssakid sponges are common in some post-Llandoveryan collections.

#### FAUNA OF THE MOUNT APRIL FORMATION

Fossils from the Mount April Formation were collected from two sections, the South Sikanni Chief River and the North Chesterfield Lake. In the former, a total of five collections were studied. Collection S 16140 contains a trilobite pygidium and fragments closely resembling Bellefontia and a collection made by Pan American Petroleum Corporation from 1,000 feet below the top of the Mount April Formation contains a trilobite pygidium assigned with qualification to Bellefontia nonius Walcott (Plate XIII, Figures 26, 27). This species occurs in the Mons Formation of southwestern Alberta and reliable literature citations for this taxon suggest that it is confined to Zone B of Ross (1951) and Hintze (1952). Other fossils from this section comprise orthid brachiopods, ?Lingulella sp., a gastropod, and possibly a conulariid. The brachiopods are not silicified and are largely indeterminate. The collections are Canadian but a more precise age assignment is not possible.



In the North Chesterfield Lake section, the Mount April Formation yields a diverse fauna. Graptolites collected near the top of the formation likely represent the Didymograptus protobifidus Zone. Below this, shelly faunas from five intervals and one float collection were studied. The faunas are very interesting since they contain rather different assemblages to those described by Ross (1951), Hintze (1952), and Kobayashi (1955). The closest similarity appears to be with the faunas described by Lochman (1965; 1966) from the Williston Basin, but here again there are noticeable differences. Most of the fossils were obtained from "hash" lenses. In these, the larger fossils are broken up and hence in faunal lists the preponderance of small or immature specimens, which are more readily identifiable, is to some extent exaggerated. Acid produced insoluble residues of the "hash" contain abundant cephalic spines and other fragments of larger but indeterminate trilobites.

The youngest trilobite collection comes from the interval 2,063 feet to 2,066 feet in the section and contains two pygidia and other fragments which are tentatively assigned to Trigonocerca sp. (Plate XIII, Figures 12, 13). Associated are Conotreta sp. and indeterminate molluscs. This collection possibly represents Zone H of Ross (1951) and Hintze (1952). Conotreta ranges from the oldest to the youngest trilobite collection and hence is of little stratigraphic importance.

Between 2294 feet and 2346 feet in the North Chesterfield Lake section, "hash" lenses yield Shumardia in abundance. This is the most common trilobite in the collections and ranges down to the oldest interval. It also occurs as high as the Isograptus caduceus Zone in the Nahanni region (Lenz and Jackson, 1964, page 899). Kobayashi (1955, page 471) describes a species of Shumardia from the Kainella-Evanaspis fauna which does not compare with any at hand, but Wilson (1954, page 275) describes an unnamed species from probably the Dagger Flat Formation of the Marathon Uplift, Texas which is conspecific with the oldest species at hand (from collections ED 6456 and ED 6457).



Robsonoceras has a similar range to Shumardia in the North Chesterfield Lake section. A large number of very well preserved specimens of this ellesmerocerid were studied. All have a circular cross section and possess a siphuncle which is  $1/5$  to  $1/6$  the diameter of the conch. In some specimens however, the sutures possess shallow ventral lobes. These lobes are not developed to the extent of the lobes in Ventroloboceras but they do suggest a close connection between these two genera. The range of Robsonoceras in this section is interesting in view of the fact that Kobayashi (1955, page 367) found the genus in only one collection from the McKay Group which he assigned to the Apatokephalus-Peltura faunule.

Float collection ED 6439 is probably from the same fauna as collections ED 6417, ED 6418, and ED 6419 and contains Conotreta sp., Shumardia sp. in abundance, and Robsonoceras sp. Associated are Matherellina sp. (abundant), a new genus of bellerephontid gastropod aff. Megalomphala, ?Isoteloides sp., and Protopliomerops sp. Protopliomerops ranges from Zone F to Zone H in Utah and Nevada but it is very characteristic of Zone G.

The lowest three collection, which range over 139 feet of section, contain similar assemblages. The most common brachiopod is Elkania sp., specimens of which are very well preserved. Another inarticulate brachiopod genus is present in collection ED 6443 and in the lowest interval, Conotreta, Lingulepis, and the Orthida are represented. The orthid brachiopod is very small with a straight hinge line, a sulcus, and fairly coarse ribs. Gastropods are well represented by Lytospira sp. (orthostrophic type), ?Matherillina sp., aff. Megalomphala sp. (very common), ?Ophileta sp. (very common in collection ED 6443), Schizopea sp., and Tropididiscus sp. Robsonoceras sp. is very common in collection ED 6443.

Of particular interest is the presence of bryozoans (two undetermined genera) which are rare in the Canadian.

Echinoderm columnals and Problematica which may be echinoderm fragments are common. Problematica comprise star-like processes with five or more off-shoots



and bilaterally symmetrical processes which may be echinoderm vascular processes.

Correlation of these three collections is presently only possible on the association of the trilobites but precise correlation is difficult because none of the trilobites has been identified to species level. Agnostids are fairly common and are represented by ?Geragnostus sp., Hyperagnostus sp., and ?Micragnostus sp. Geragnostus is common in Zone A but unpublished studies in the southern Canadian Rockies suggest that it ranges as high as Zone D (Norford, personal communication, 1966). Lochman (1965, page 468) records the genus from Zone D. Hyperagnostus is recorded by Kobayashi (1955, page 366) from the Kainella-Evansaspis fauna. Shumardia sp., Hystricurus sp., Apatokephalus sp., and a protopliomerid are also present. This association is suggestive of the Apatokephalus-Peltura fauna of Kobayashi (1955) and this is equated with Zone D.

In conclusion, three shelly assemblages appear to be represented in the Mount April Formation in the North Chesterfield Lake section. The oldest probably represents Zone D, the intermediate possibly represents Zone G, and the youngest possibly represents Zone H.

#### FAUNA OF THE ORDOVICIAN DOLOMITE UNIT

The Ordovician dolomite unit yields a small, mostly poorly preserved fauna. Only in collections from south of Gauvreau Creek have fossils been identified to species level.

Collections from the Sikanni Chief River area through to the Lady Laurier Lake area collectively include the following fossils:

Eofletcheria sp. undet.

Beatricea sp.

Receptaculites sp.

?Lingulella sp.

Orbiculoidea sp.  
(continued)



?Rafinesquina sp.

?Sowerbyella sp.

rhynchonellid brachiopod

Liospira sp.

Maclurites sp.

Raphistomina sp.

euomphalid and murchisonid gastropods

aff. Kochoceras sp.

Orthoceras sp.

?Vaginoceras sp.

The Middle Ordovician genus Eofletcheria is present in collections from the South Sikanni Chief River section. The species is probably new: the corallum is orthoconic; individual corallites are rounded or irregular; tabulae and septa are lacking.

The brachiopod fauna is present in only one collection from the top of the Ordovician dolomite unit in the South Sikanni Chief River section and is associated with Receptaculites sp. The age of this collection is post-Early and probably Middle Ordovician.

Poorly preserved gastropods are fairly common but do not allow a more refined age assignment than Ordovician.

The cephalopods are also mostly poorly preserved but Orthoceras (sensu stricto) is present in two collections and suggests a Middle Ordovician age.

South of Gauvreau Creek, three spot collections which are probably from the Ordovician dolomite unit, contain a more diverse fauna. Collection S 15147 which is either from this unit or the Ordovician argillaceous carbonate unit, contains a solitary coral and this indicates a Porterfield or younger age. It is associated with a large specimen of Maclurites, Michelinoceras sp., a sponge, and a thick-shelled pelecypod.



Collection S 15138 contains Bimuria buttsi Cooper which occurs in the Porterfieldian Little Oak Formation of Alabama (Cooper, 1956, page 765). Ceratopea sp. is also present in this collection and as elsewhere this genus is restricted to Lower Ordovician rocks it is possible that the collection is mixed. Other fossils present are Lichenaria sp. and Orthambonites sp. (both Middle and Upper Ordovician genera), an undetermined plectambonitid brachiopod, and an actinocerid cephalopod with a flat venter and a compressed siphuncle (aff. Kochoceras sp.) which is also present in collection ED 65145 from the Calnan Creek-Halfway River divide.

Collection S 15146 contains three brachiopod species: Orthambonites cf. subconvexus Cooper, Orthambonites cf. marshalli (Wilson), and an undetermined orthid brachiopod. O. subconvexus occurs in the Whiterockian Oil Creek Formation of Oklahoma (Cooper, 1956, page 313). O. cf. marshalli differs from the holotype of O. marshalli in possessing four additional costae on each valve. O. marshalli was originally described as an Upper Ordovician species by Wilson (1926) but it is now clear that the field collections were lumped (Harker, Hutchinson, and McLaren, 1954, page 52) and that the species is either late Early or early Middle Ordovician. O. marshalli occurs in a fauna collected at Cecilia Lake, 110 miles northwest of Jasper, from the Ordovician dolomite unit (Harker, Hutchinson and McLaren, 1954, page 61) and O. cf. marshalli has been collected by Norford from the Clearwater Creek section where it is associated with a new brachiopod genus related to Orthidiella. The undetermined orthid brachiopod occurs in the Skoki Formation of the southern Canadian Rockies (Norford, oral communication, 1966).

In conclusion, there is no evidence to suggest that the Ordovician dolomite unit is anywhere of Late Ordovician age and it is largely, if not entirely, Middle Ordovician (including Whiterockian).



### LATE ORDOVICIAN SHELLY FOSSILS

Late Ordovician fossils have been collected from the Peace River area and from the Clearwater Creek Section. Tedrick (1962) also records Late Ordovician fossils from the Prophet River area.

In the Peace River area, Irish (1964, page 815) records Middle Ordovician fossils from two localities on Advance Mountain and thus the Ordovician section seems to be more or less complete. Late Ordovician fossil collections from the argillaceous carbonate unit include Diceromyonia tersa (Sardeson), Lepidocyclus erectus Wang, L. rectangularis Wang, Opikina limbrata Wang, and Strophomena amoena Wang. All these species occur in the Maquoketa Shale of Iowa (Wang, 1949). Irish (1964, page 816) lists three species of Thaerodonta from the Peace River area and the entire fauna is likely correlative with the Richmondian Bighornia - Thaerodonta Fauna of the lower part of the Beaverfoot Formation of southeastern British Columbia which has been discussed by Norford (1962b).

This Bighornia - Thaerodonta Fauna is well represented in two collections from the Clearwater Creek section which contain a rich fauna of corals (including Bighornia sp.) and brachiopods.

Tedrick (1962, Figure 3) has identified Bighornia in a collection from an unnamed peak south of Richards Creek, a southern tributary of the Prophet River. In the same section occur Calapoecia, Catenipora, and Manipora. This fauna occurs above what is probably a basal transgressive sandstone and the containing beds are probably onlapped eastwards.

### SILURIAN SHELLY FOSSILS

Norford (written communication, 1966) states: "The Silurian benthonic faunas of northern British Columbia are mostly undescribed and therefore the stratigraphic ranges and biologic variations of the taxa are very poorly known. In part-



icular, the favositid, halysitid, and rugose corals need detailed study before they can confidently be used for biostratigraphic dating".

The Silurian fossil collections at hand are most conveniently described under the following scheme:

3. post-Sandpile coralline member collections
2. Sandpile coralline member collections
1. pre-Sandpile coralline member collections

1. Pre-Sandpile coralline member collections

Collections representing faunas older than that of the Sandpile coralline member are known from the North Sikanni Chief River section and the Mount Kenny section

In the former, the oldest collection (S 16029) includes ?Asthenophyllum sp., Catenipora sp. Palaeofavosites sp., and ?Clorinda sp. These fossils are difficult to date. Elsewhere they are found with a species of Palaeophyllum and the faunule is either Llandoveryan or Richmondian (Norford, written communication, 1966). Above this, collection S 16028 includes ?Gypidula sp. and Pentamerus sp. and collection S 16027 contains Palaeofavosites sp. and Pentamerus sp. Norford (written communication, 1966) dates these collections as Late Llandoveryan to Wenlockian and states that collection S 16028 is "probably part of a fauna that is found just above the base of the dark dolomite unit in the Tuchodi Lakes Map-area". Stratigraphic evidence suggests that a Late Llandoveryan age is more likely.

In Mount Kenny section 1, collections S 8457 and S 8456 both contain Halysites sp. and a species of Palaeofavosites with 2-2 1/2 mm. corallites. Halysites indicates a Silurian age and Norford (written communication, 1966) states that: "a species of Palaeofavosites with 2 1/2 - 3 mm. corallites is present in GSC collections from Upper Llandovery rocks near Guilbault Creek." The age relationships of these two collections with those of the North Sikanni Chief River



section is unknown.

Strata containing these collections are probably absent in the Peace River area where Richmondian strata are overlain by beds which probably contain the Sandpile coralline fauna.

## 2. Sandpile coralline member collections

The Sandpile coralline member is only 95 feet thick in the Turnagain River area (Norford, 1962, page 4) but the fauna from this member may range through as many as 1,000 feet of strata in the Halfway River area. Extensive collections from this interval were made from the North Sikanni Chief River section through to the Peace River area. The fauna comprises Cystihalysites spp., Halysites spp., Catenipora spp., Favosites spp., Palaeofavosites spp., Heliolites spp., Propora sp., Thamnopora sp., Striatopora sp., Fletcheria deadwoodensis Norford, Syringopora verticillata Goldfuss, undetermined tubular corals, undetermined solitary corals, and minor brachiopods, gastropods, stromatoporoids, and sponges. The interval containing this fauna also contains much chert.

Only five fossils have been positively identified to species level. Halysites compactus Rominger is an easily recognized species which has also been recorded from the same locality (North Sikanni Chief River section) by Jull (1961, page 32). Jull's age assignment of Late Silurian is probably incorrect though. Catenipora simplex (Lambe), Fletcheria deadwoodensis Norford, Syringopora verticillata Goldfuss, and Atrypa parva Hume have also been recorded by Norford (1962a).

It is probable that the Silurian fossils from the Clearwater Creek section represent the Sandpile coralline member fauna. The collections include Columnaria columbia Norford, Favosites spp., Coenites sp., and halysitid corals.

Problems of correlation of the Sandpile coralline member with other sequences in North America has been covered by Norford (1962a). The age assignment of the



fauna is Late Llandoveryan and possibly Early Wenlockian. North of Lady Laurier Lake, the Sandpile coralline fauna is overlain by graptolites belonging to the latest Llandoveryan zone of Monograptus spiralis.

### 3. Post-Sandpile coralline member collections

Post-Sandpile coralline member shelly collections have been made from the Silurian dolomite unit and the Silurian siltstone unit. In the former, Favosites sp. undet. (Plate XXI, Figures 1-3), a favositid coral, and an undetermined lithistid sponge have been collected in the North Sikanni Chief River section from just below the Devonian dolomite unit. The age of this collection is unknown but a halysitid coral and Multisolenia sp. are found just over 100 feet below and these indicate a Silurian age.

In the South Calnan Creek section, an undetermined species of Favosites (Plate XXI, Figures 12, 14) occurs in talus 200 feet below the top of the Silurian siltstone unit. The age of this specimen is completely unknown and Devonian cannot be ruled out. In the South Slade Creek section, a coral faunule is found in pockets of dolomite 145 feet above the base of the Silurian siltstone unit. This includes ?Columnaria sp., Fletcheria sp., and Craterophyllum aff. invaginatium (Davis). The age assignment (based on graptolites) is latest Llandoveryan or Early Wenlockian.

Tentative correlation of the graptolite zones and the shelly assemblages is shown in Figure 4 .



#### CHAPTER IV : SUMMARY AND CONCLUSIONS

Three facies belts can be recognized in the Ordovician and Silurian of the northern Rocky Mountains. Platform carbonates are developed in the eastern belt but these pass westwards through a mixed facies into eugeosynclinal mudstones and siltstones.

The widespread Mount April Formation can be recognized in the three facies belts. It is at least 2,170 feet thick and consists of argillaceous limestones and calcareous mudstones. The clay content of the Mount April increases westwards into the eugeosynclinal belt. All fossil collections from this formation are of Canadian age and trilobites probably of Zones D, G, and H have been found on Cloudmaker Mountain. Graptolites from near the top of the Mount April likely represent the Didymograptus protobifidus zone. The Mount April Formation overlies unfossiliferous Cambrian ( ? ) sandstones and shales but the nature of the contact is not known. The Mount April is overlain by the Cloudmaker Formation in the eugeosynclinal facies belt and by an unnamed dolomite unit in the other two facies belts. The upper contact of the Mount April Formation is not diachronous to any extent.

The Cloudmaker Formation can be readily divided into three members in the Akie River Area: a lower shale and siltstone member; a quartzite member; and an upper shale and siltstone member. The lower member is 1,183 feet thick at the type section on Cloudmaker Mountain but attains its maximum thickness on the south side of the Calnan Creek valley where it is 1,425 feet thick. In the Kwadacha River area this lower member contains a large thickness of volcanic rocks. The base of the Cloudmaker Formation is strongly diachronous: the oldest graptolite collection in the Akie River area represents the Didymograptus protobifidus Zone but in the Halfway River area in the mixed facies belt, graptolite collections



from near the base of the unit represent the Climacograptus bicornis Zone.

The Ordovician dolomite unit of the platform facies belt contains a White-rockian and Middle Ordovician shelly fauna and is thus a facies equivalent of the lowest part of the Cloudmaker Formation in the eugeosynclinal facies belt. This Ordovician dolomite unit is 2,373 feet thick just north of the summit of Mount Kenny and this location is the best potential type section.

The highest graptolite zone of the lower shale and siltstone member of the Cloudmaker Formation is that of Orthograptus truncatus intermedius. The overlying quartzite member is well developed in the eugeosynclinal and mixed facies belts and attains a fairly constant thickness of 300 feet. This quartzite member is missing in the Kwadacha River area and northwards due, probably, to overstep by the Sandpile Group. Shale beds near the base of the quartzite member yield graptolites representing the zone of Orthograptus quadrimucronatus and possibly, also, the underlying zone of Orthograptus truncatus intermedius.

The upper shale and siltstone member of the Cloudmaker Formation is presently only known from the Akie River area where it is at most 85 feet thick. Graptolites from this member represent the latest Ordovician zone of Dicellograptus complanatus ornatus.

In sections on Wedge Peak and Advance Mountain, just north of the Peace River, carbonates yield Middle and Upper Ordovician shelly assemblages. An Upper Ordovician sandstone unit is present which likely correlates with the quartzite member of the Cloudmaker Formation.

The Sandpile siltstones in the eugeosynclinal belt are at least 1,212 feet thick but their upper contact is not preserved in the sections studied. Graptolite collections are mostly from near the base of the unit and represent the zones of Monograptus cyphus, M. turriculatus, and M. spiralis. The zone of M. gregarius



may also be present. The M. cyphus Zone is possibly overlapped northwards from the Kwadacha River area into the Cloudmaker Mountain area where the oldest Silurian zone found is that of M. turriculatus. The highest graptolite collection contains a species of Cyrtograptus of Wenlockian type. The upper age limit of the Sandpile siltstones is unknown but no Late Silurian fossils have yet been recorded from northern British Columbia.

In the mixed facies belt, the following threefold division of the Sandpile Group is made: Silurian (and Ordovician?) mudstone unit; Silurian dolomite unit; and Silurian siltstone unit. The Silurian (and Ordovician ?) mudstone unit is 655 feet thick and contains a fauna of diplograptid graptolites which are assigned, with qualification, to the zone of Diplograptus modestus. Southwards and northwards this unit passes into platform dolomites and a transitional facies of laminated, argillaceous dolomites is exposed in the Lady Laurier Lake area. Westwards into the eugeosynclinal facies, the mudstone unit is either overlapped or overstepped by younger Silurian rocks. These younger beds undergo a facies change from dolomite to mudstone westwards.

The Silurian dolomite unit is 367 feet thick in the Calnan Creek area but it thickens rapidly, and partly at the expense of the Silurian (and Ordovician ?) mudstone unit, northwards. It is also thicker in the Peace River area where the lowest part of the dolomite unit contains Richmondian fossils. Throughout the platform and mixed facies belts, the fauna of the Sandpile coralline member of the Cassiar Mountains is well developed. A slightly earlier Llandoveryian fauna is also represented in sections in the Mount Kenny and Sikanni Chief River areas.

The upper contact of the Silurian dolomite unit is possibly slightly diachronous with the overlying Silurian siltstone unit. This siltstone unit carries a Mono-graptus spiralis zonal assemblage at its base in the Lady Laurier Lake area. The youngest fossil collection from the Silurian siltstone unit contains a new species



of Favosites but its age is presently unknown.

The Silurian siltstone unit is overlain, probably unconformably, by massive, unfossiliferous dolomites and sandy dolomites which are probably of Early Devonian age. In the Peace River area, these overlie the Silurian and Ordovician dolomite unit and progressively truncate this unit southwards to the Clearwater Creek section.

It is probable that a regional unconformity is present at the base of the Silurian (and Ordovician. ?) mudstone unit. The temporal magnitude of the unconformity increases northwards towards the Chesterfield Lake area. It is also probable that a hiatus is present beneath strata containing the Sandpile coralline member fauna in some sections.

The Ordovician and Silurian of the northern Rocky Mountains can be correlated fairly readily with the Ordovician and Silurian of the McDame area and the Cordillera as a whole.

Throughout the Cordillera, the facies distribution comprises shallow water carbonates to the east or northeast and deep water fine clastics and argillaceous carbonates to the west. Locally the linear trend is broken by carbonate encroachment, for example in the McDame area, and coarse clastics bear evidence of periodic uplift or terrigenous clastic influx. Coarse sand is particularly common in the Upper Ordovician and Silurian rocks but the source of the sand is not known. The unconformity separating Silurian from Ordovician rocks in northeastern British Columbia possibly reflects a "high" situated near the 60th parallel.

It is clear that much work remains to be done on the Ordovician and Silurian of the northern Rocky Mountains and it is germane to pose some of the more important questions remaining unanswered:

- i) what is the lower age limit of the Mount April Formation?
- ii) is the quartzite member of the Cloudmaker Formation overlapped or overstepped



northwards from the Akie River area?

iii) what is the upper age limit of the Sandpile Group?

iv) are Late Ordovician graptolites present at the base of the mudstone unit in the Calnan Creek area?

v) what is the source of the widespread sand?

In addition, there is a pressing need for taxonomic studies and detailed zoning of the graptolitic and shelly strata.



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PLATE VI

(Except Figure 13, all figures X2)

Figures:

Zone of Didymograptus protobifidus

1. Didymograptus columbianus Ruedemann, GSC 65955
2. Tetragraptus sp., GSC 65955

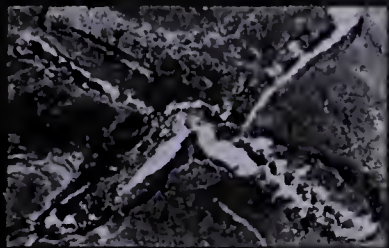
Zone of Isograptus caduceus

- 3, 4. Isograptus sp. A, ED 6470
5. Isograptus sp. B, ED 6470
6. Isograptus sp., GS 1061 A 2284'-2310'
7. Isograptus sp., GS 10 61A 2284'-2310'
- 8, 15, 16. Isograptus caduceus divergens Harris, ED 6468
- 9, 10. Didymograptus aff. nitidus (J. Hall), 9 - ED 6468  
10 - ED 6470
11. Didymograptus aff. extensus (J. Hall), ED 6468
12. Didymograptus procumbens T.S. Hall, ED 6468
13. Didymograptus sp., X1, ED 6468
14. Isograptus cf. caduceus divergens Harris, ED 6471
- 17, 18. Phyllograptus aff. angustifolius J. Hall ED 6468
19. Isograptus caduceus maximo-divergens Harris, ED 6471
20. Dichograptus cf. marathonensis Berry, ED 6471
21. Dichograptus cf. octobrachiatus (J. Hall), ED 6472
22. Dichograptus sp., ED 6470
23. Dichograptus sp., GS 10 61A 2284'-2310'

PLATE VI.



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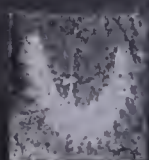
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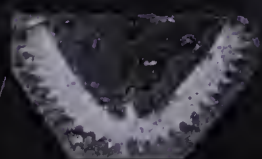
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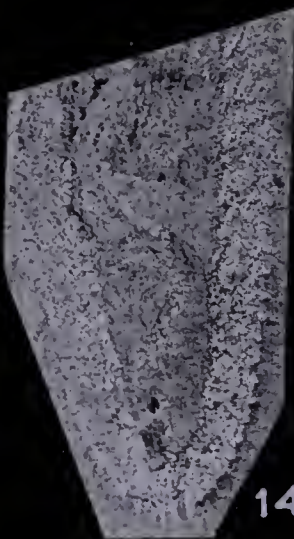
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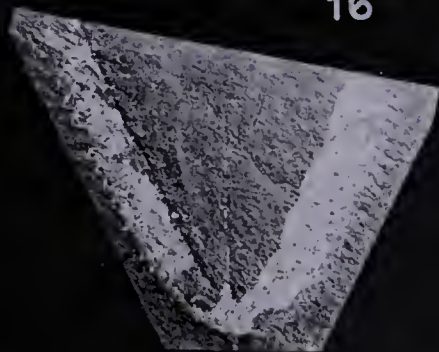
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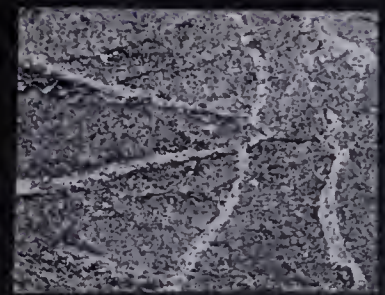
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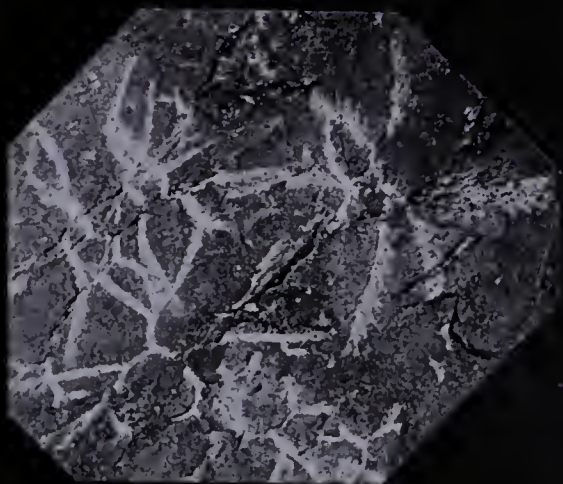
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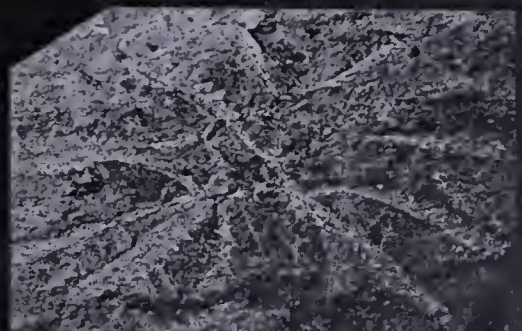
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PLATE VII

(Except Figure 29, all figures X2)

Figures:

Zone of Paraglossograptus etheridgei

1. Cryptograptus sp., GS 10 61A 2237'-65'
2. Cryptograptus cf. hopkinsoni (Nicholson), GS 1061A 2207' 37'
3. Cryptograptus schaferi (Lapworth), DS 1961A 1825'
4. Cryptograptus sp. A, GSC 65975
- 5,6. Climacograptus aff. antiquus Lapworth, GSC 65975
7. Climacograptus sp., GSC 65975
- 8,14. Glyptograptus cf. euglyphus (Lapworth), GSC 65975
9. Isograptus forcipiformis (Ruedemann), GS 1061A 2002'-49'
10. Isograptus cf. caduceus nanus Ruedemann, GS 1061A 2237'-65'
11. Undetermined graptolite, GSC 65975
- 12,24. Cryptograptus antennarius (J. Hall), ED 6467
13. Glyptograptus teretiusculus (Hisinger), ED 6467
15. Isograptus aff. ovatus (T. S. Hall), GSC 65975
16. Glossograptus cf. acanthus Elles and Wood, GS 1061A 2207'-37'
17. Didymograptus aff. v-deflexus Harris, DS 1961A 1825'
18. Didymograptus serratulus (J. Hall), GSC 65975
19. Trigonograptus ensiformis (J. Hall) GSC 45618
20. Paraglossograptus etheridgei (Harris), ED 6467
- 21,26,27. Pterograptus sinicus Mu, GSC 65975
- 22,23. Glossograptus aff. hincksii (Hopkinson), GSC 65975
25. Tetragraptus bigsbyi var. latus Hsu, ED 6467
28. ?Sinograptid graptolite, GS 1061A 2237'-65'
29. Tetragraptus sp., GS 1061A 2002'-49', X1
30. Tetragraptus aff. pendens Elles, ED 6467

PLATE VII.



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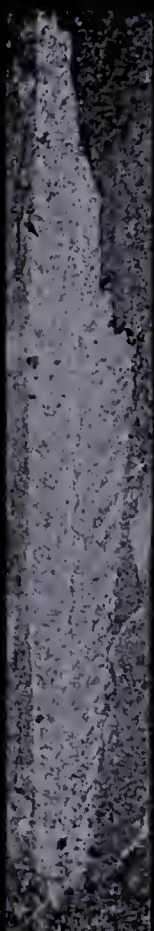
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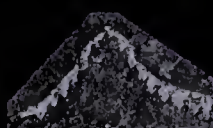
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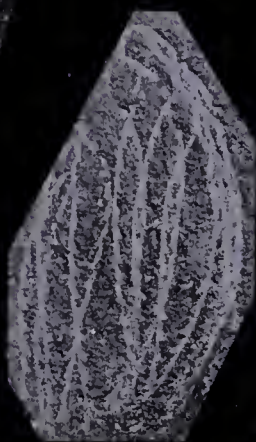
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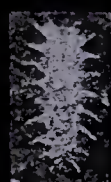
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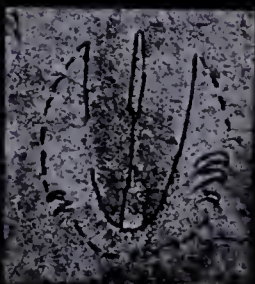
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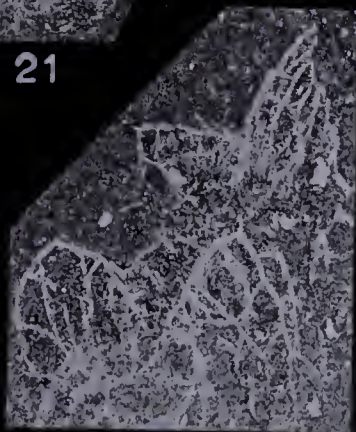
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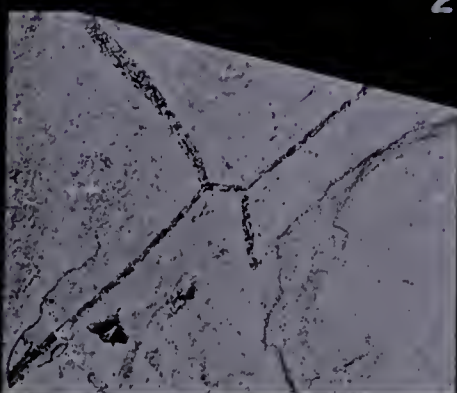
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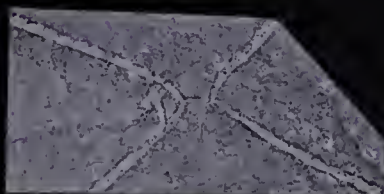
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PLATE VIII

(All figures X2)

Figures:

Zone of Climacograptus bicornis

1. Orthograptus calcaratus acutus Elles and Wood, ED 65129
2. ?Hallograptus sp., DS 1961A 1451'
3. Climacograptus cf. spiniferus Ruedemann, GS 1061A 1275'
4. Dicranograptus cf. contortus Ruedemann, GS 1061A 1260'
5. Orthograptus whitfieldi (J. Hall), DS 1961A 1451'
6. Dicellograptus sp., GS 1061A 1292'
7. Dicellograptus elegans Carruthers, GSC 65953
8. ?Diplograptus ingens T. S. Hall, DS 1961A 1451'
9. Dicranograptus cf. ramosus longicaulis Elles and Wood, GS 1061A 1285'
10. Dicranograptus nicholsoni geniculatus Ruedemann and Decker, S 16131
11. Dicranograptus nicholsoni Hopkinson, ED 652
12. Dicranograptus cf. nicholsoni diapason Gurley, DS 1261A 350'
13. Climacograptus bicornis longispina T. S. Hall, GSC 65953
14. Climacograptus bicornis peltifer Lapworth, GSC 65953
15. Climacograptus cf. bicornis tridentatus, Lapworth, DS 1261A 287'
16. Climacograptus bicornis (J. Hall), GS 1061A 1260'

Zone of Glyptograptus euglyphus

17. Retiograptus geinitzianus J. Hall, GSC 66015.
18. Climacograptus riddellensis Harris, GSC 66000
19. Phyllograptus nobilis Harris and Keble, GSC 65972
20. Glossograptus sp., GSC 65972
21. Glossograptus hincksii (Hopkinson), GSC 65972

Zone of Nemagraptus gracilis

22. Cryptograptus tricornis (Carruthers), GSC 65977
23. ?manubriate isograptid graptolite, GSC 65977
24. ?Nemagraptus gracilis (J. Hall), GSC 65977
25. Glyptograptus euglyphus (Lapworth), GSC 65977

PLATE VIII.



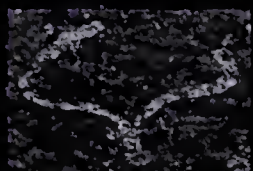
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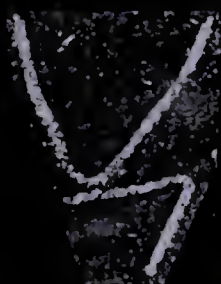
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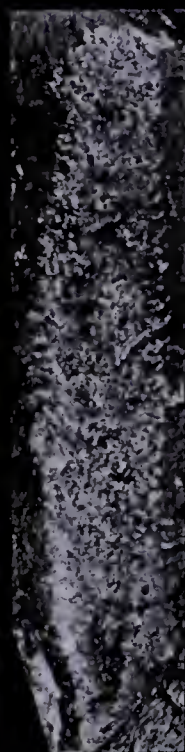
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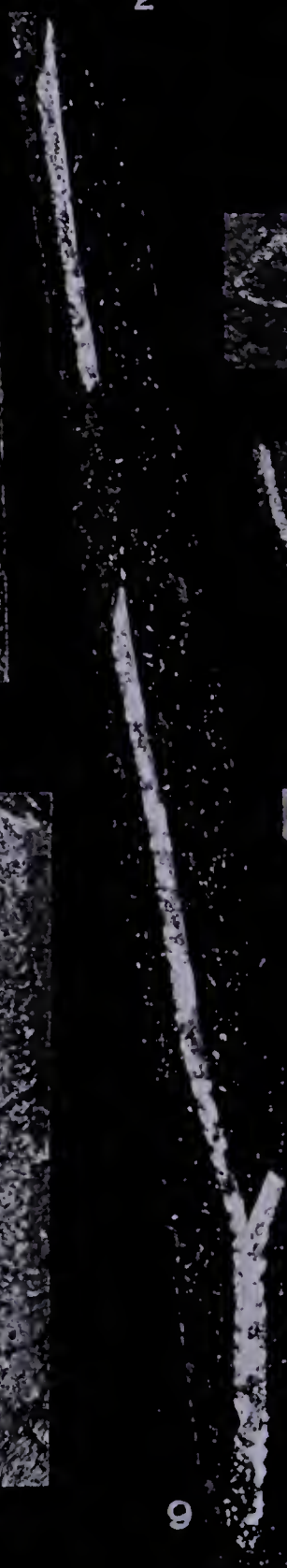
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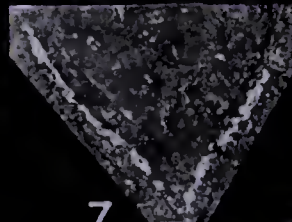
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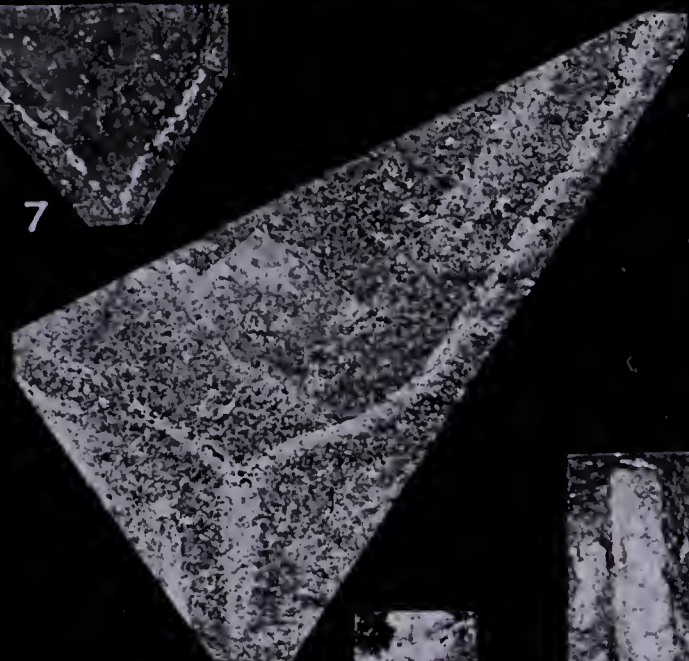
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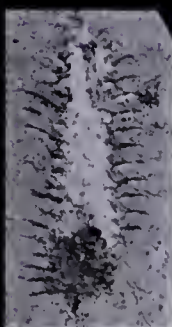
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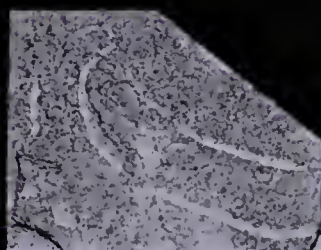
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PLATE IX

(All figures X2)

Figures:

Zone of Orthograptus truncatus intermedius

1. Orthograptus truncatus intermedius Elles and Wood, GSC 65957
2. Orthograptus truncatus cf. intermedius Elles and Wood, GSC 65938
3. Orthograptus calcaratus cf. basilicus Elles and Wood, S 16040
4. Orthograptus truncatus cf. var. strigosus Ross and Berry, GSC 65938
5. Retiograptus cf. pulcherrimus Keble and Harris, GSC 66008
6. Retiograptus sp., GSC 66008
7. Orthograptus quadrimucronatus inequispinosus Ruedemann, GSC 65938
8. Climacograptus bicornis (J. Hall), GSC 65957
9. Orthograptus calcaratus (Lapworth), DS 12 61A 175'
10. Climacograptus cf. typicalis J. Hall, GSC 65957
11. Climacograptus cf. tubuliferus Lapworth, GSC 66017
- 12, 13. Dicranograptus cf. hians T.S. Hall, GS 10 61A 1235'
14. Orthograptus aff. quadrimucronatus spinigerus (Lapworth), DS 19 61A 1255'
15. Orthograptus ex gr. calcaratus, GSC 65938
16. Dicellograptus cf. gurleyi Lapworth, GSC 65956
17. Dicranograptus cf. kirki Ruedemann, GSC 65957
18. Dicellograptus sp. A, GSC 66017
19. Leptograptus flaccidus (J. Hall), GSC 65957

Zone of Orthograptus quadrimucronatus

20. Orthograptus truncatus pauperatus Elles and Wood, S 15420
21. Dicellograptus cf. forchammeri flexuosus Lapworth, GSC 65981
- 22, 23. Leptograptus flaccidus macer Elles and Wood, 22 - ED 65152, 23 - DS 19 61A 1106'
24. Climacograptus cf. caudatus Lapworth, DS 14 61A 1144'. To the right is Plegmatograptus sp. (Figure 25)

PLATE IX.

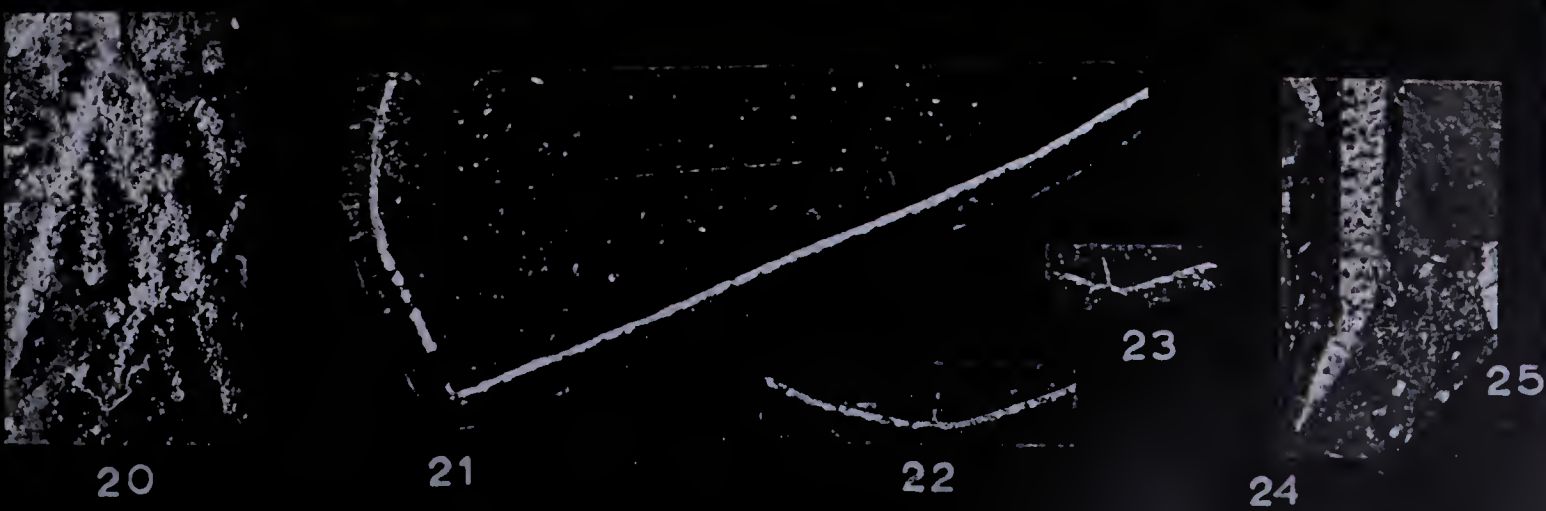
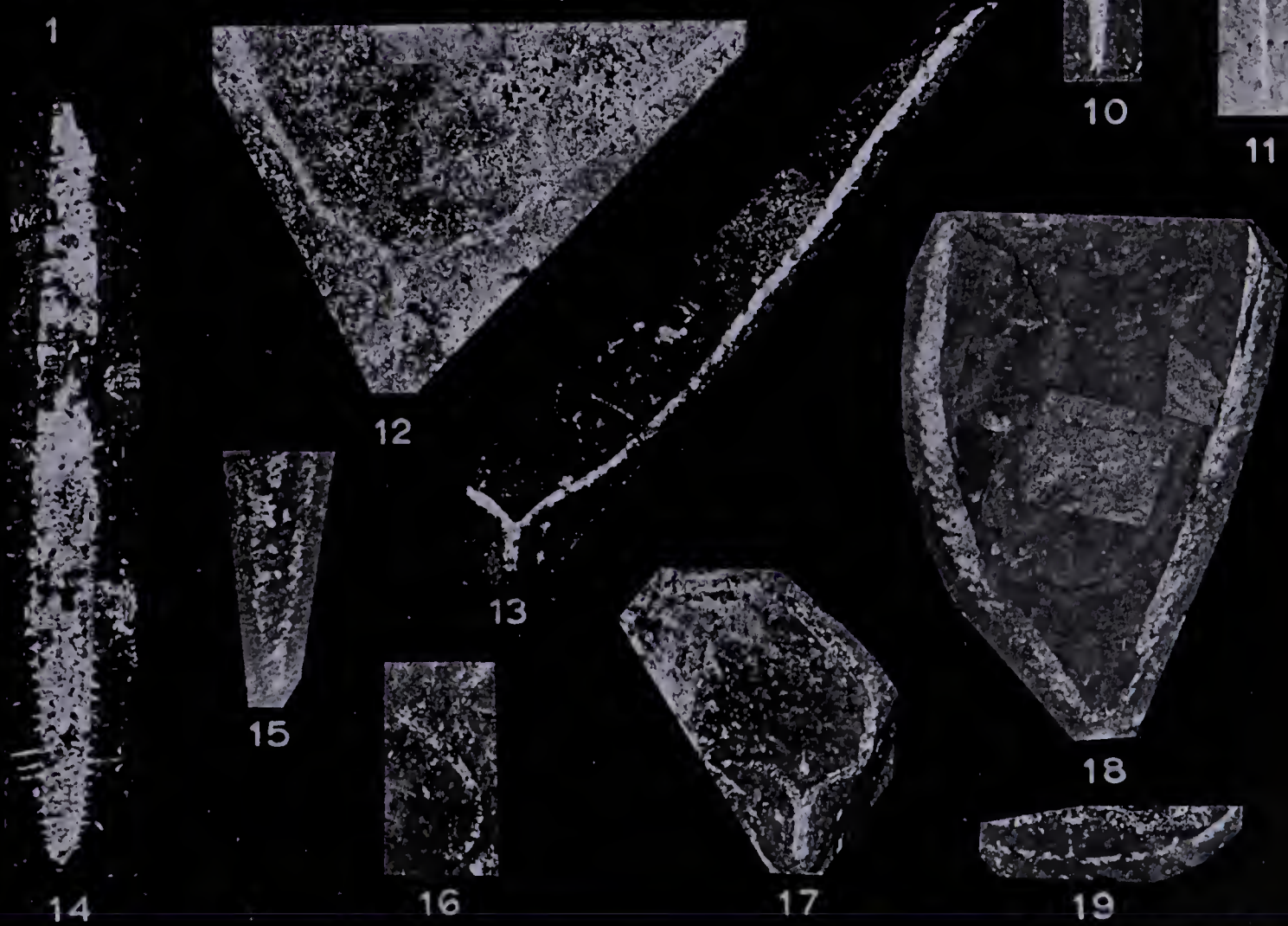
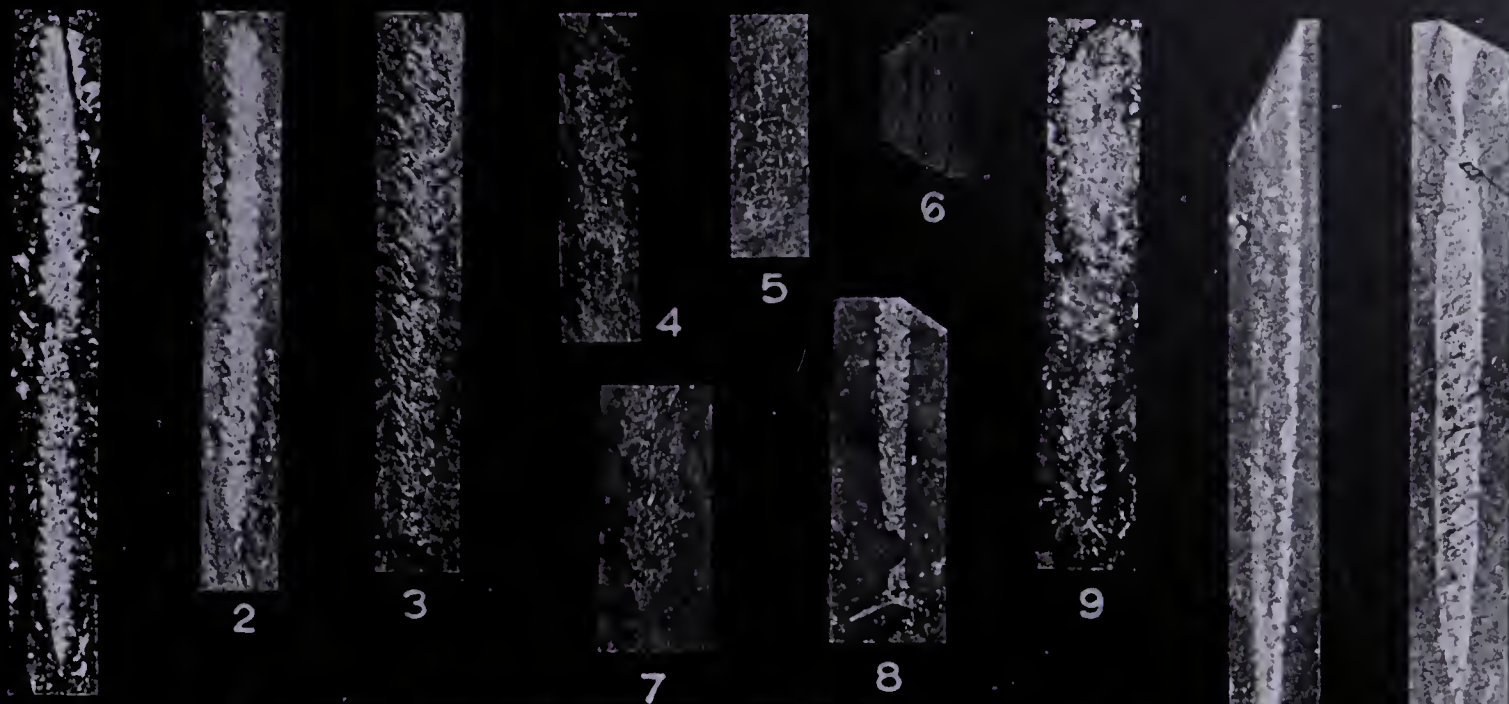






PLATE X

(All figures X2)

Figures:

Zone of Orthograptus quadrimucronatus (continued)

1. Dicellograptus cf. johnstrupi Hadding, DS 19 61A 1106'
2. Orthograptus quadrimucronatus cf. spinigerus (Lapworth), ED 65152
3. Climacograptus cf. spiniferus Ruedemann, DS 19 61A 1106'
4. Orthograptus quadrimucronatus (J. Hall), DS 19 61A 1106'
5. Diplograptus multident compactus Lapworth, S 15420
6. Dicellograptus cf. morrisi Hopkinson and Orthograptus ex gr. quadrimucronatus, DS 19 61A 1106'
7. Orthograptus calcaratus cf. basilicus Elles and Wood, GSC 65981
- 8,9. Climacograptus raricaudatus Ross and Berry, GSC 65985
10. Orthograptus aff. whitfieldi (J. Hall), GSC 65985
11. Dicranograptus kirki Ruedemann, GSC 65985

Zone of Dicellograptus complanatus ornatus

12. Orthograptus calcaratus var. undet., GSC 65956
- 13,15. Dicellograptus complanatus Lapworth, GSC 65956
14. Climacograptus innotatus pacificus Ruedemann, DS 19 61A 842'
- 16,21. Diplograptus crassitestus Ruedemann, 16 - GSC 65956, 21 - DS 19 61A 842'
17. Orthograptus truncatus abbreviatus Elles and Wood, GSC 65956
18. Orthograptus ex gr. calcaratus GSC 65956
19. Climacograptus hastatus T.S. Hall, GSC 65956
20. Dicellograptus complanatus ornatus Elles and Wood, DS 19 61A 842'

PLATE X.







PLATE XI

(All figures X2)

Figures:

?Zone of Diplograptus modestus

1. Climacograptus cf. scalaris normalis Lapworth, ED 6596.
2. ?Orthograptus vesiculosus penna (Hopkinson), ED 6597
- 3, 4. Glyptograptus cf. tamariscus (Nicholson), ED 6592

Zone of Monograptus cyphus

5. Orthograptus vesiculosus (Nicholson), sícula with th 1' and th 2', GSC 65961
- 6, 7. Dimorphograptus confertus swanstoni (Lapworth), GSC 65961
8. Climacograptus ex gr. scalaris, GSC 65961
9. Climacograptus cf. medius Tornquist, GSC 65961
- 10, 12. Monograptus cf. concinus Lapworth, GSC 65961
11. Glyptograptus persculptus Salter, GSC 65961
13. Diplograptus sp. A, GSC 65950
- 14, 15. Monograptus cf. acinaces Tornquist, GSC 65961
16. Monograptus concinnus Lapworth, GSC 65963

Zone of Monograptus turriculatus

17. Monograptus cf. exiguus (Nicholson), GS 10 61A 1155'
18. Monograptus cf. proteus (Barrande), DS 12 61A 10'
19. Monograptus cf. turriculatus (Barrande), DS 12 61A 115'
20. Monograptus turriculatus minor Bouček, GS 10 61A 1173'
21. Monograptus ex gr. vomerinus, GS 10 61A 1155'
22. Monograptus cf. halli (Barrande), GS 10 61A 1183'

?Zone of Monograptus gregarius

23. Monograptus cf. gregarius Lapworth, DS 19 61A 750'

PLATE XI.



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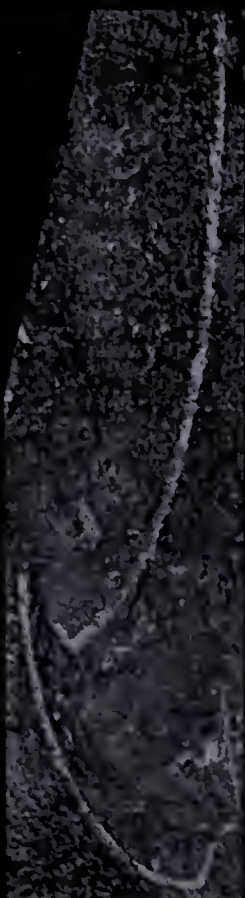
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PLATE XII

(Except Figures 6 and 7, all figures X2)

Figures:

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1. Cyrtograptus sp. and Monograptus sp., GSC 65988
2. Monograptus priodon (Bronn), S 15416
3. Monograptus cf. dubius (Suess), GSC 65960

Zone of Monograptus spiralis.

4. Retiolites geinitzianus (Barrande), GSC 66017
5. Dictyonema sp., ED 6539
6. Cyrtograptus cf. lapworthi Tullberg, GSC 65976, X1
7. ?Barrandeograptus sp., ED 6539, X1
8. Monograptus ex gr. priodon, ED 6539
9. Monograptus cf. spiralis (Geinitz), ED 6539

PLATE XII.



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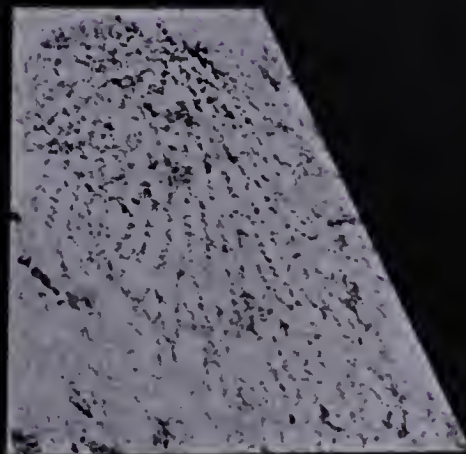
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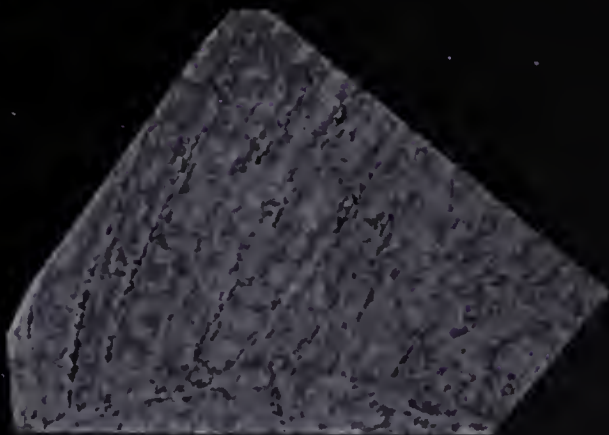
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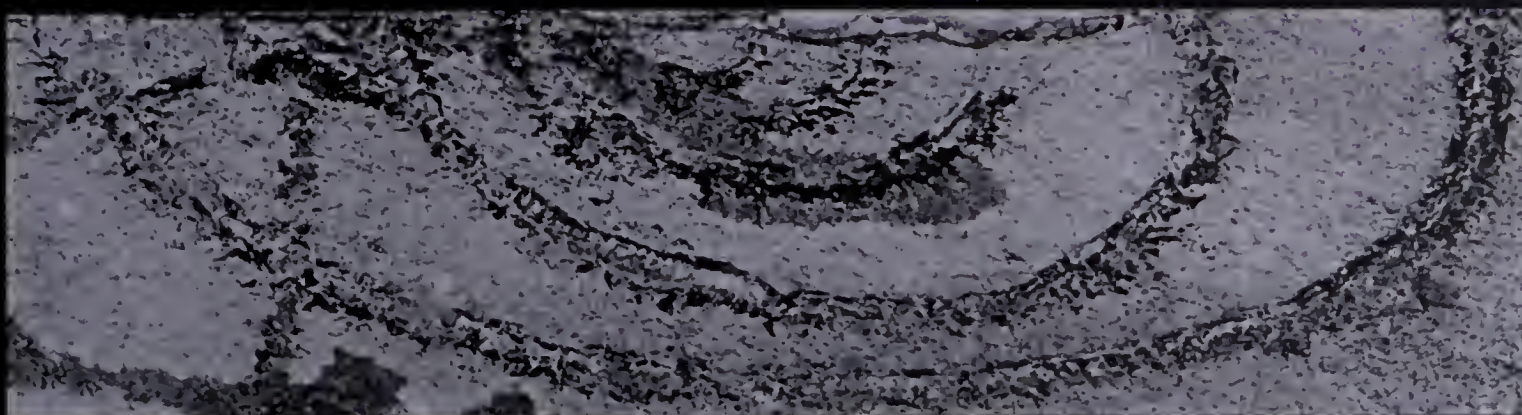
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PLATE XIII

Trilobites from the Mount April Formation

(Except Figures 26 and 27, all figures X15)

Figures:

- 1,2,7,8,9,11. Shumardia sp. undet., cephalons, 1,2,7-9 from collection ED 6439, 11 from collection ED 6417, 18, 19
3. Shumardia sp. undet., cephalon, ED 6456, 57
4. Undetermined cranidium, ED 6456, 57
5. ?Hystriacus sp., cranidium, ED 6456, 57
6. Hystriacus sp., cranidium, ED 6443
10. Shumardia sp. undet., cephalon, ED 6443
- 12,13. ?Trigonocerca sp., pygidial spines, ED 649
- 14,18. Hyperagnostus sp., cephalons, ED 6456, 57
- 15,16. Micragnostid trilobite, cephalons, ED 6456, 57
17. Protopliomerid trilobite, pygidium, ED 6443 (specimen lost after it was photographed).
19. ?Geragnostus sp., cephalon, ED 6443
20. Apatokephalus sp., cranidium, ED 6443
21. Undetermined free cheek, ED 6443
- 22,25. Protopliomerops sp., pygidia, ED 6439
23. Undetermined pygidium, ED 6439
24. Undetermined cranidium, ED 6443
- 26,27. ?Bellefontia nonius Walcott, dorsal and posterior views of pygidium, X2, DS 14 61A 2330'
- 28,30,32. ?Apatokephalus sp., cranidium and pygidium from collection ED 6443 and pygidium from collection ED 6453, 54
29. ?Hystriacus sp., free cheek, ED 6443
31. Undetermined pygidium, ED 6443

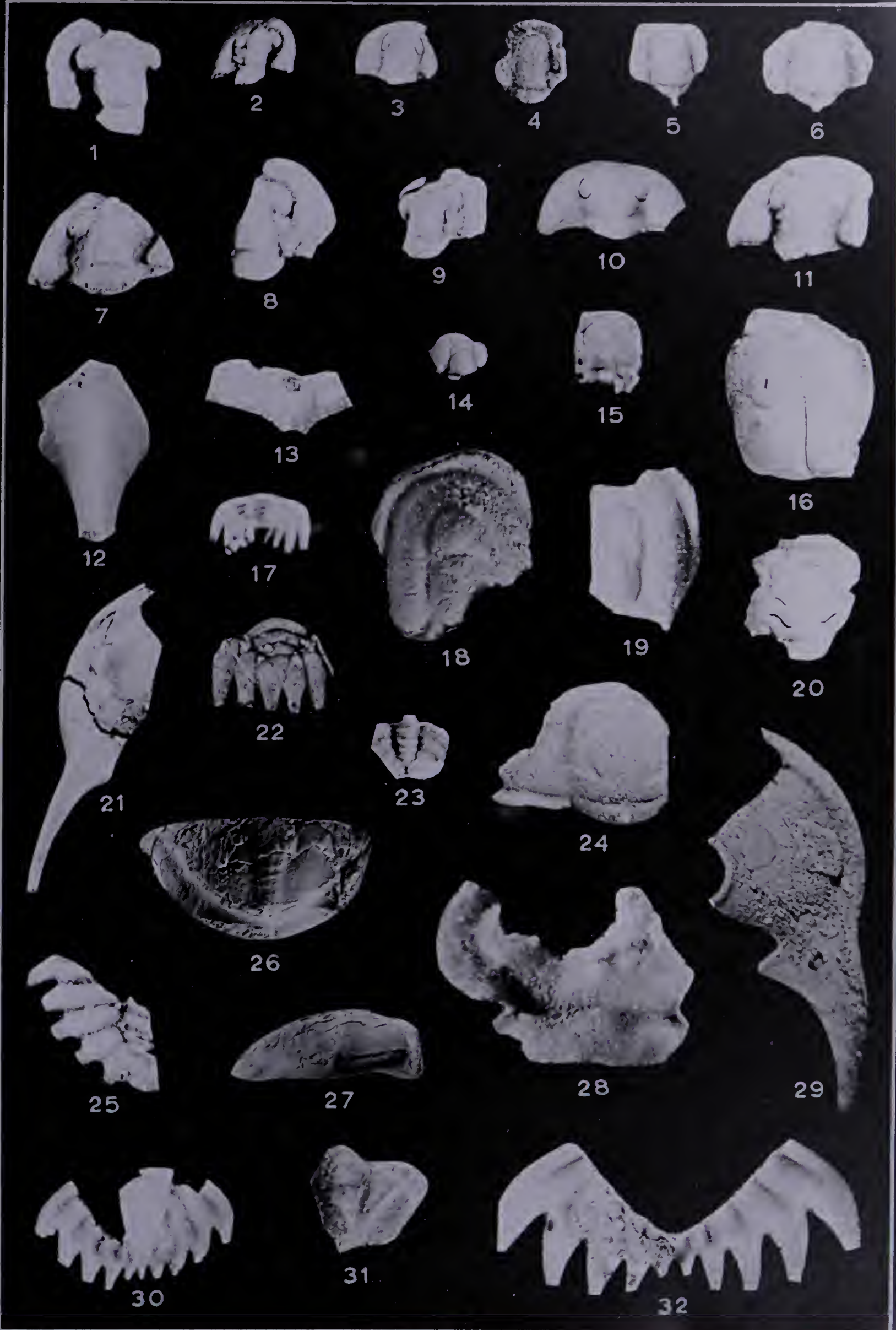






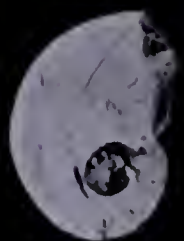
PLATE XIV

Fossils from the Mount April Formation

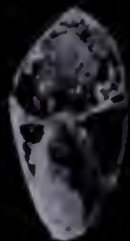
(All X15)

Figures:

- 1,2. Tropidodiscus sp., lateral and apertural views, ED 6443
- 3,4. Orthid brachiopod, posterior view showing pedicle and pedicle view, ED 6456,57
- 5-7. aff. Megalomphala sp., apertural, dorsal, and lateral view, ED 6443
8. Schizopea sp., apical view, ED 6456,57
9. Conotreta sp., side view of pedicle valve, ED 6517, 18,19
- 10,11,12,17,21. Undetermined bryozoans, 10 and 17 from collection ED 6453, 54, 11 and 21 from collection ED 6443, 12 from collection ED 6456,57
- 13,16. Matherellina sp., lateral and apertural views, ED 6439
- 14,15. Lingulepis sp., pedicle view and view of interior of pedicle valve, ED 6456,57
18. Problematica, possibly belongs to Echinodermata, ED 6453, 54
19. Problematica, possibly belongs to Echinodermata, ED 6453,54
- 20,24. Elkania sp., view of interior of pedicle valve and pedicle view, ED 6443
- 22,25. Problematica, top and bottom views, ED 6443
23. Echinoderm columnal, ED 6443
- 26,29,30. ?Ophileta sp., apertural, apical, and basal views, ED 6443
- 27,28. Robsonoceras sp., ventral view and anterior view of another specimen showing circular cross section and marginal siphuncle, ED 6443



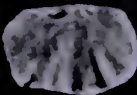
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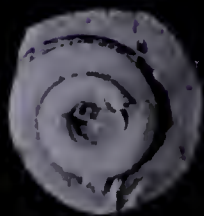
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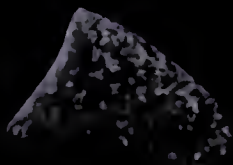
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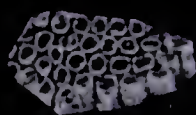
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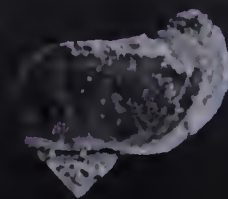
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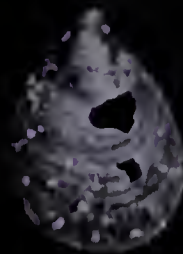
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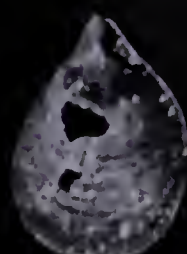
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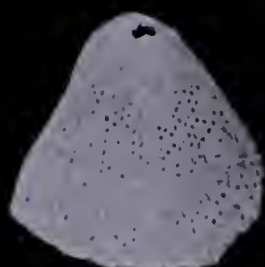
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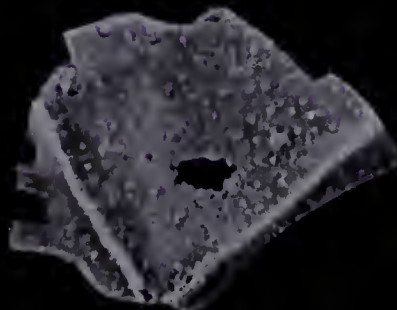
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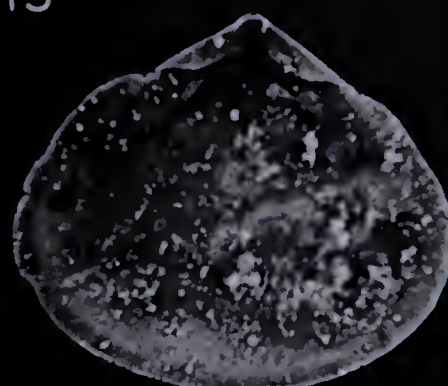
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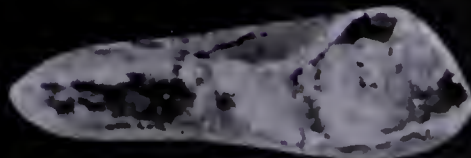
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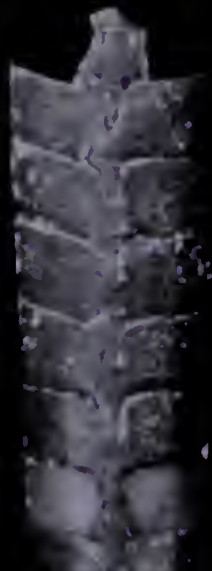
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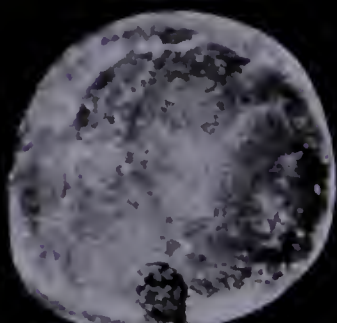
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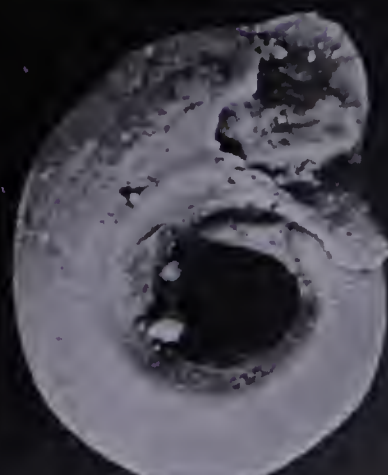
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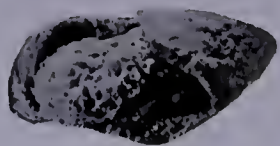
PLATE XV

Fossils from the Ordovician dolomite unit

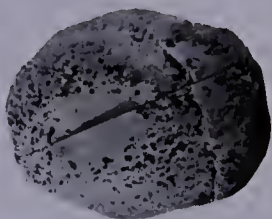
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Figures:

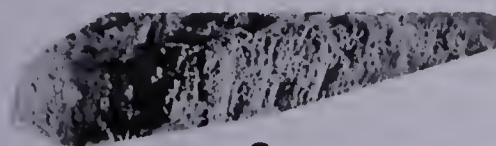
1. Undetermined sponge, top view of partly broken specimen, S 15147
- 2,24. Lichenaria sp., 2 - top view of corallum, 24 - surface of corallum (X15), S 15138
- 3,4,25. Eofletcheria sp., 3 - side view of part of corallum from collection S 16143, 4 - longitudinal section of part of corallum from collection S 16144, 25 - transverse section of corallum (X15) from collection S 16144
- 5,6. Undetermined sponge, 5 - top view of half of specimen (X2), 6 - side view of same broken specimen (X2), S 15138
- 7,8. Receptaculites sp., 7 - longitudinal section, 8 - top view, S 16139
- 9,10. aff. Kochoceras sp., 9 - anterior view showing flattened venter and compressed siphuncle, 10 - longitudinal section, S 15138
- 11,12. Beatricea sp., 11 - top view, 12 - side view of partly broken specimen, DS 14 61A 880'
- 13, 16. Michelinoceras sp., 13 - transverse section, 16 - longitudinal section, S 15147
- 14,15. Ceratopea sp., side views, S 15147
17. Liospira sp., apical view, X2, S 16039
- 18, 21. Orthoceras sp., 18 - longitudinal section (X2) of specimen from locality S 16030, 21 - longitudinal view (X2) of weathered specimen from locality S 16039
- 19,22,23. ?Vaginoceras sp., siphuncle, 19 - transverse section, 22 - longitudinal section, 23 - longitudinal view, S 16030
20. Maclurites sp., top view, ED 6550



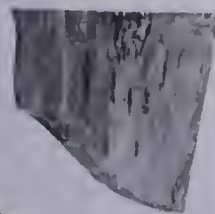
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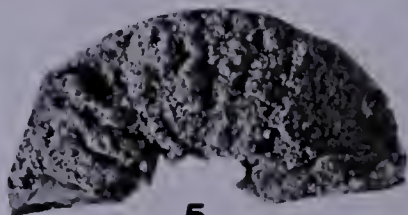
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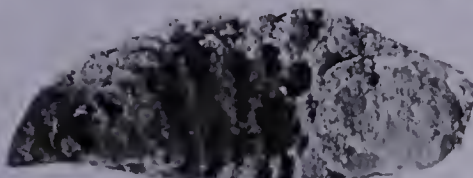
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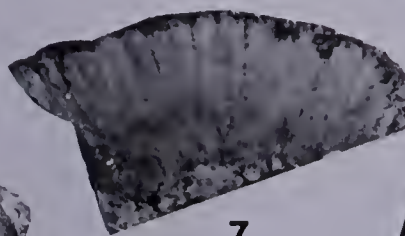
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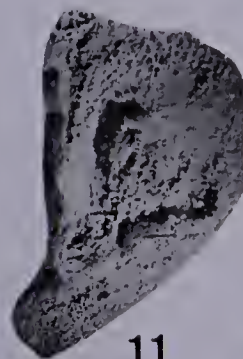
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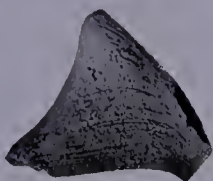
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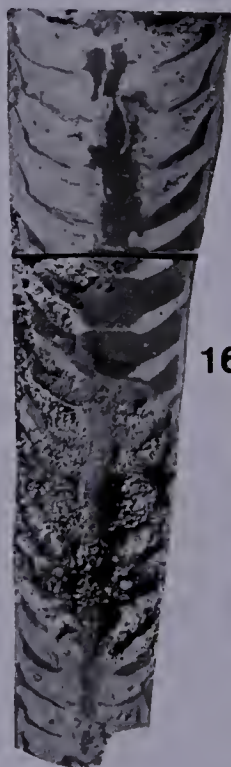
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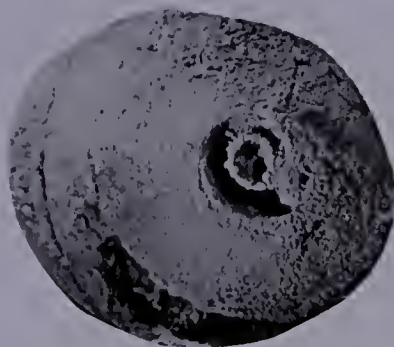
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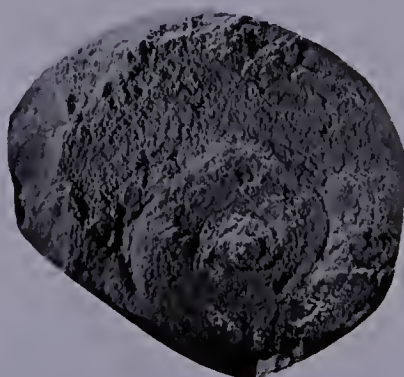
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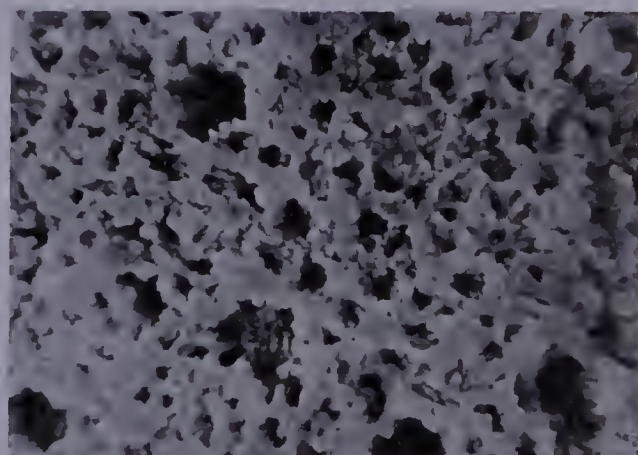
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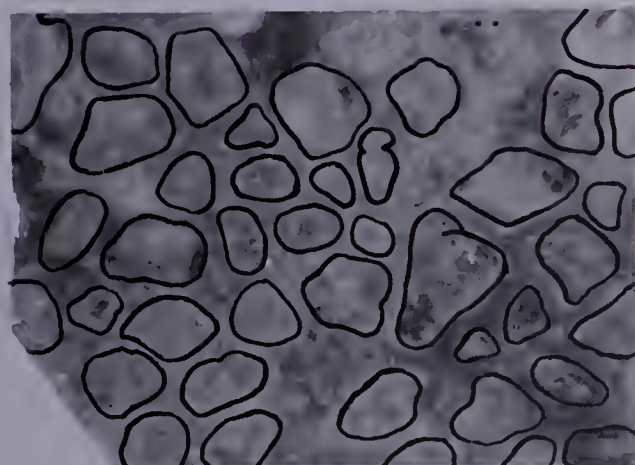
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24



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PLATE XVI

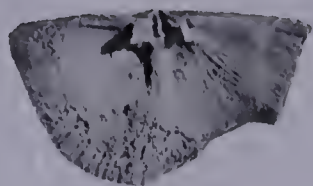
Ordovician brachiopods

(Except Figure 6a, all figures X2)

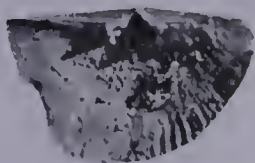
Figures:

- 1a-g. Undetermined orthid brachiopod, a - view of interior of brachial valve, b - view of interior of pedicle valve, c - pedicle view, d - brachial view, e - side view, f - posterior view, g - anterior view, S 15146
- 2a-e. Orthambonites cf. marshalli (Wilson), a - side view of pedicle valve, b - pedicle view, c - view of interior of pedicle valve, d - anterior view of pedicle valve, e - posterior view of pedicle valve, S 15146
3. ?Sowerbyella sp., pedicle view, DS 14 61A 0-10'
- 4a,b. Bimuria buttsi Cooper, a - view of interior of brachial valve, b - posterior view of interior of brachial valve, S 15138
- 5a,b. Orthambonites sp., a - view of interior of brachial valve, b - brachial view, S 15138
- 6a-g. Undetermined plectambonitid brachiopod, a - side view of partly broken specimen (X1), b - side view of pedicle valve, c - posterior view of pedicle valve, d - anterior view of partly broken specimen, e - pedicle view, f - view of interior of pedicle valve, g - pedicle view of weathered specimen showing brachial apparatus, S 15138
- 7a-d. Strophomena sp., a - posterior view, b - side view, c - pedicle view, d - brachial view, S 16317

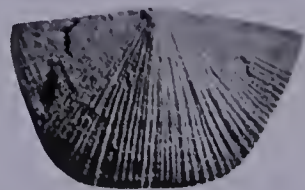
# PLATE XVI.



1a



1b



1c



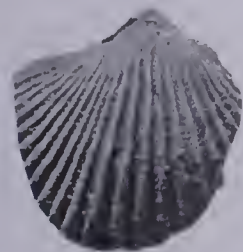
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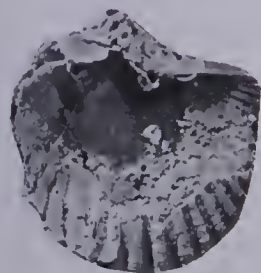
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2a



2b



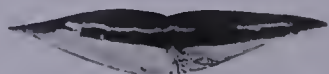
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2d



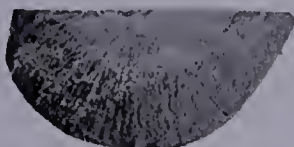
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1f



1g



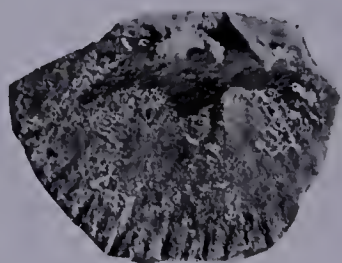
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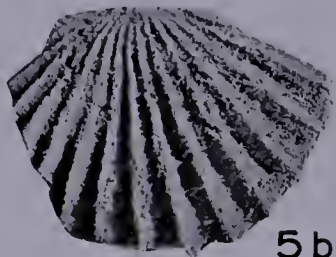
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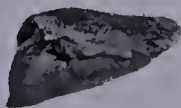
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5a



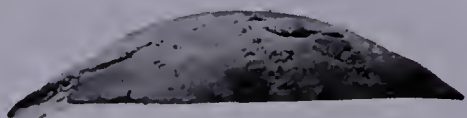
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6a



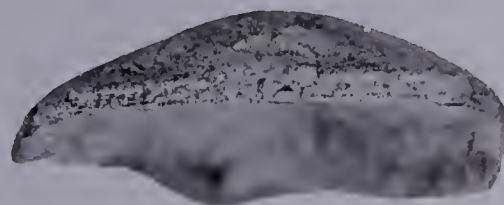
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6c



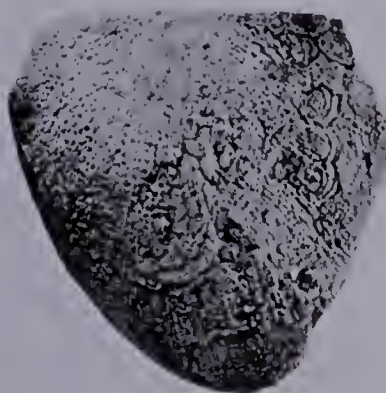
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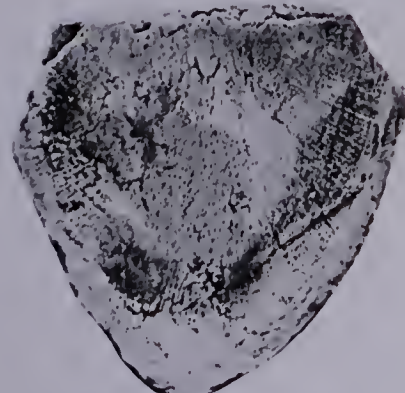
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7b



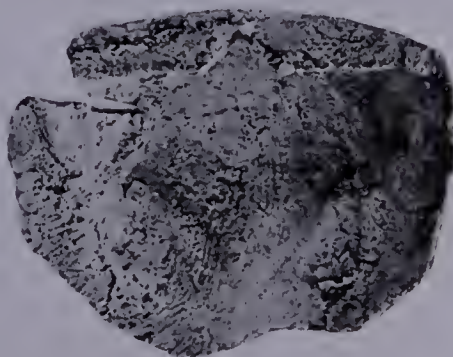
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7d



6e



6f



6g





PLATE XVII

Silurian pre-Sandpile coralline member fauna .

(All figures X2, unless otherwise stated)

Figures:

- 1-3.      ?Asthenophyllum sp., 1, 3 - lateral views of different corallites, 2 - calyx, S 16029
- 4-9.      Pentamerus sp., 4 - pedicle view, 5 - side view of pedicle valve, 6,7 - views of interior of pedicle valve, 8 - posterior view of pedicle valve, 9 - anterior view of slightly tilted pedicle valve, S 16028
- 10-13.    ?Clorinda sp., 10 - pedicle view, 11 - posterior view of pedicle valve, 12 - view of interior of pedicle valve, 13 - anterior view of interior of pedicle valve, S 16020
- 14-16.    ?Gypidula sp., 14 - posterior view of pedicle valve, 15 - side view of pedicle valve, 16 - view of interior of pedicle valve, S 16028
- 17,18.    Pentamerus sp., 17 - side view of pedicle valve, 18 - dorsal view of pedicle valve, S 16027
- 19, 20.    Catenipora sp., (1 x 3/4 mm. corallites, 10-12 tabulae in 5 mm.), 19 - top view of part of corallum (X1), 20 - transverse section of corallum (X1), S 16029
- 21, 22.    Palaeofavosites sp., (1 - 1 1/2 mm. corallites, 10 tabulae in 5 mm.), 21 - transverse section of corallum (X1), 22 - longitudinal section of corallum (X1), S 16027

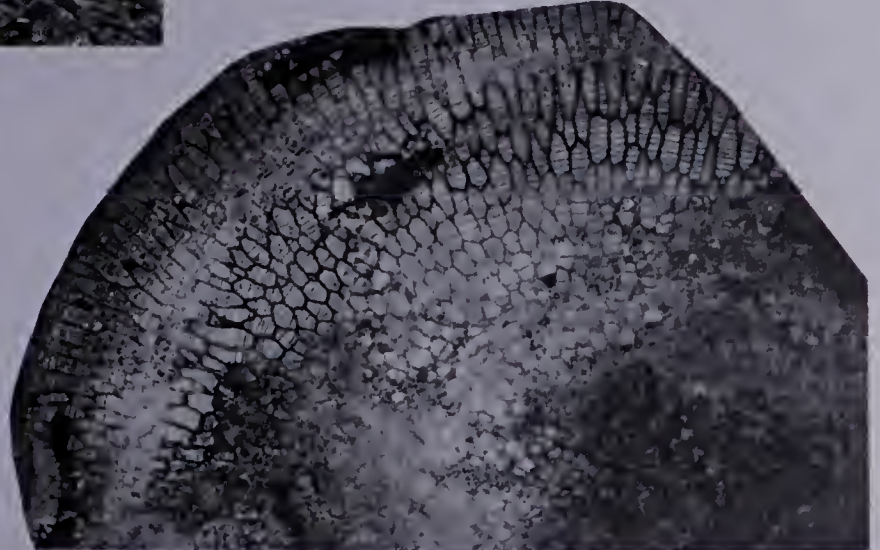
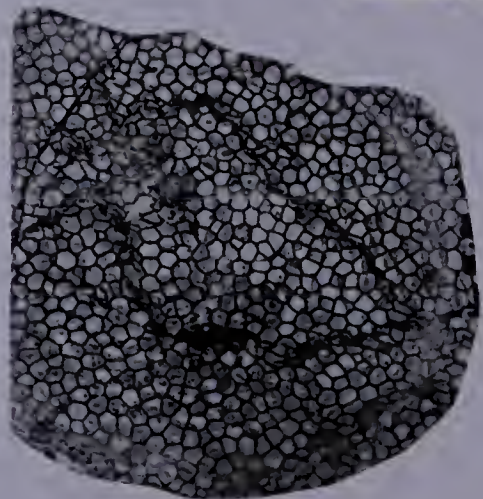
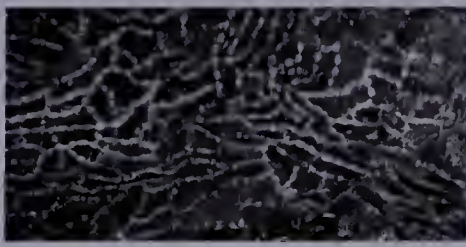
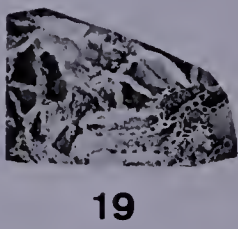
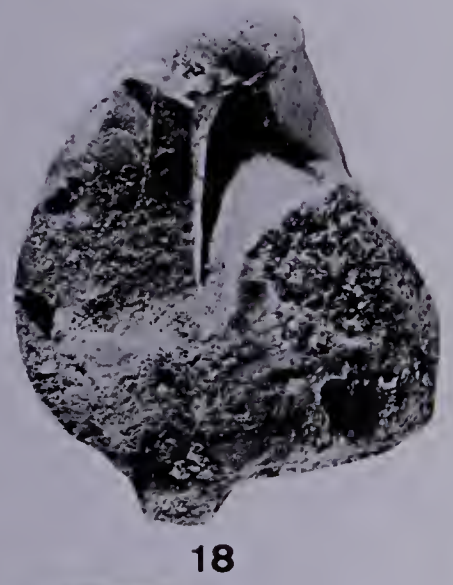
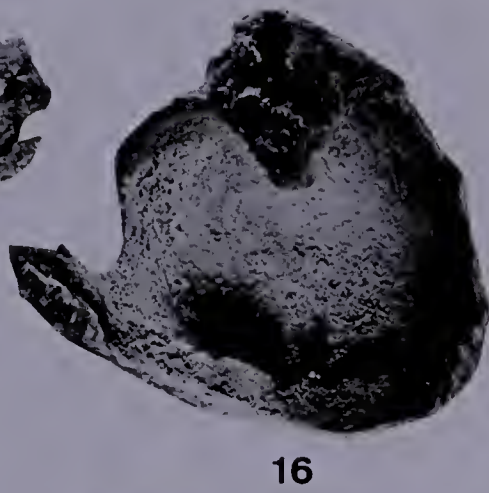
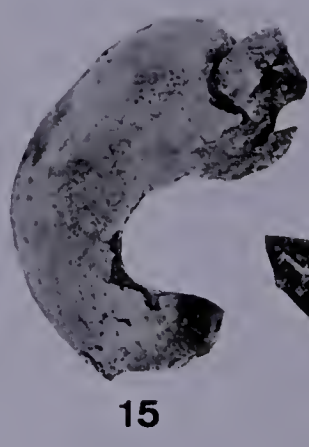
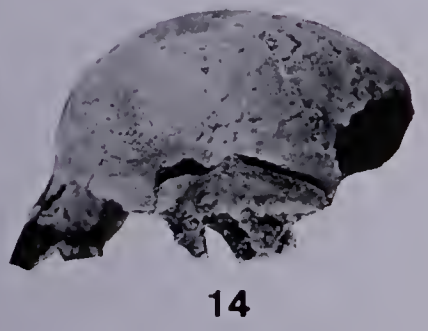
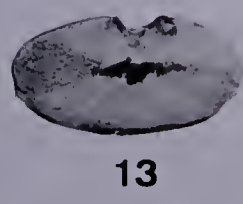
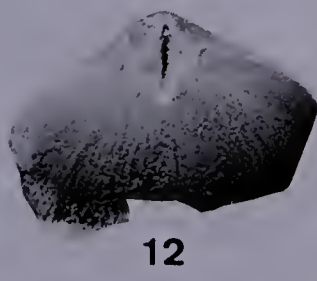
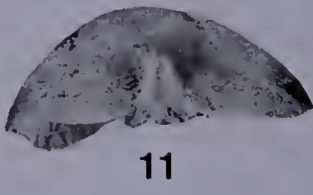
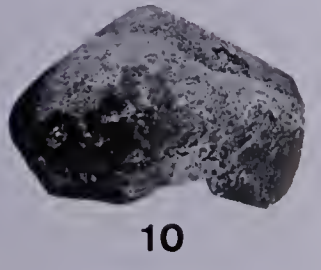
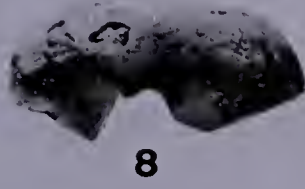
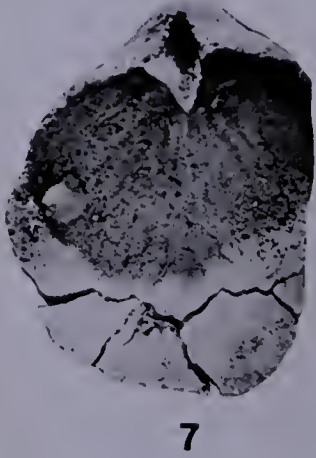
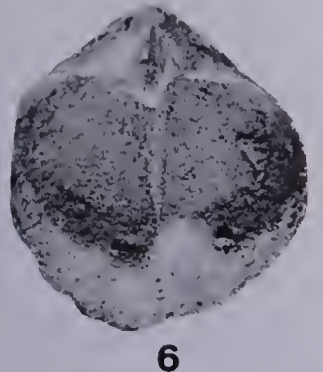
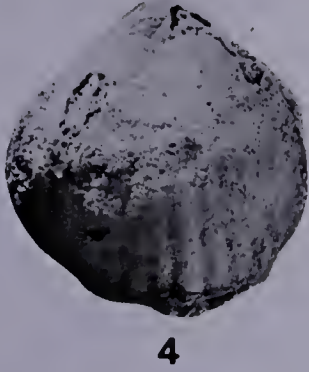






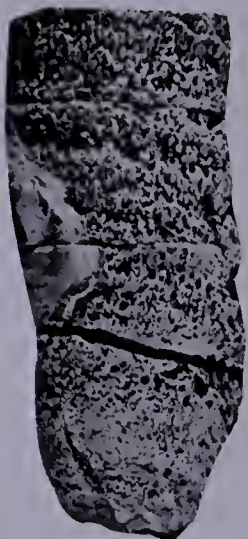
PLATE XVIII

Sandpile coralline member fauna

(Except Figure 11, all figures natural size)

Figures:

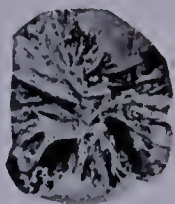
- 1-5, 8-11. Undetermined solitary corals, 1, 5, and 10 - transverse section and transverse section and lateral view of another specimen from collection ED 6537, 2 and 8 - calyx and lateral views of specimen from collection ED 6538, 3, 4, 9 - calyx view, transverse section, and lateral view of three different specimens from collection S 8449, 11 - lateral view (X2) of specimen from collection S 16025.
- 6, 7. ?Ptychophyllum sp., 6 - lateral view of specimen from collection S 8455, 7 - calyx view of specimen from collection ED 6538
12. Halysitid coral, S 16318
- 13, 14. Halysites cf. sandpilensis Norford, 13 - top view of corallum, 14 - side view of corallum, ED 6537
- 15, 16. Catenipora simplex (Lambe), 15 - transverse section of corallum, 16 - side view of corallum, ED 6537
- 17, 18. Halysites compactus Rominger, 17 - top view of corallum, 18 - transverse section of corallum, S 16024
19. Halysites sp. (1 x 1 1/2 mm. autocorallites, 11-12 autocorallite tabulae in 5 mm.), transverse section of corallum S 16042
20. Cystihalysites sp. (2 1/2 x 2 mm. autocorallites, 9-10 autocorallite tabulae in 5 mm.), transverse section of corallum S 16026
21. Catenipora sp. (2 x 1 1/2 mm. corallites, 8 tabulae in 5 mm.), top view of corallum, ED 6573
22. Halysites sp. (2 x 1 1/2 mm. autocorallites, 12-13 autocorallite tabulae in 5 mm.), transverse section of corallum, S 16319
- 23, 24. Cystihalysites sp., (2 1/2 x 2 mm. autocorallites, 8 autocorallite tabulae in 5 mm.), 23 - transverse section of corallum, 24 - side view of corallum, S 16021



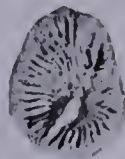
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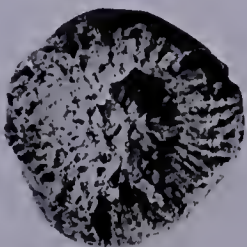
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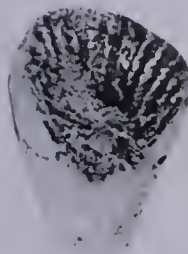
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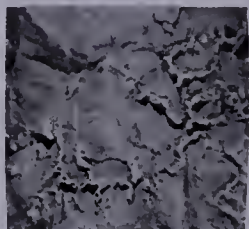
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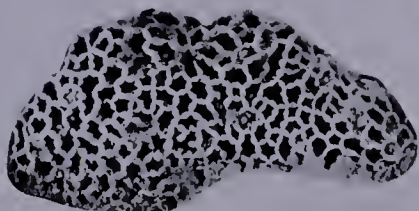
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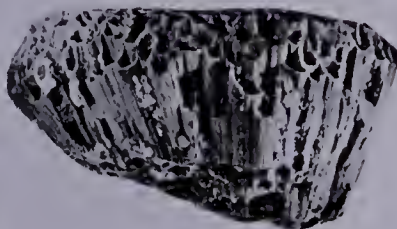
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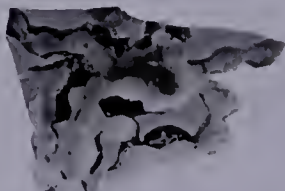
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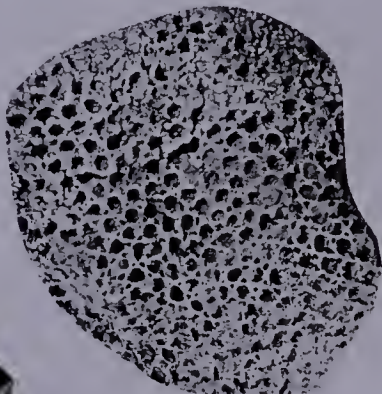
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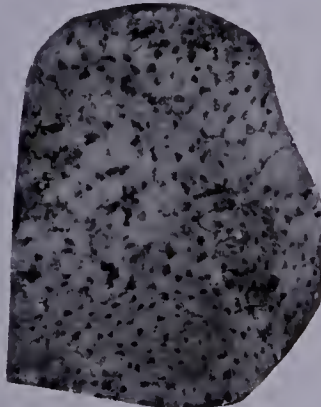
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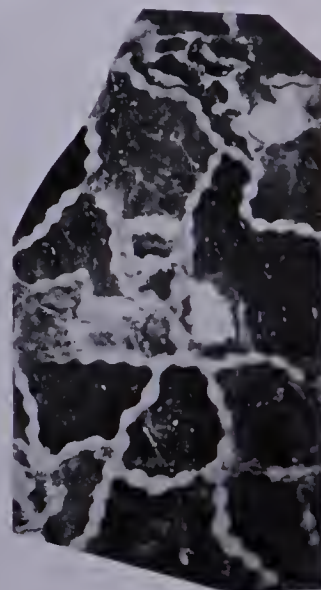
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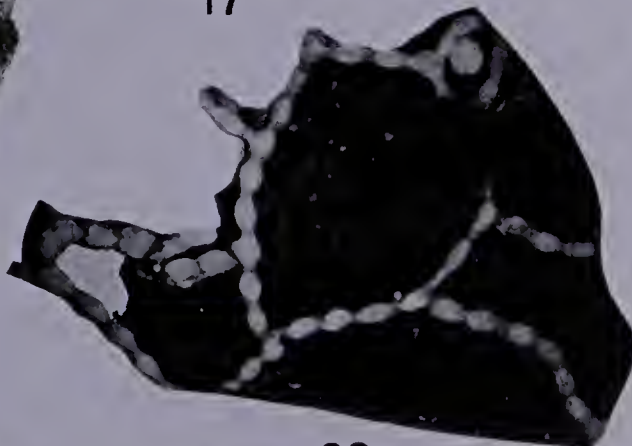
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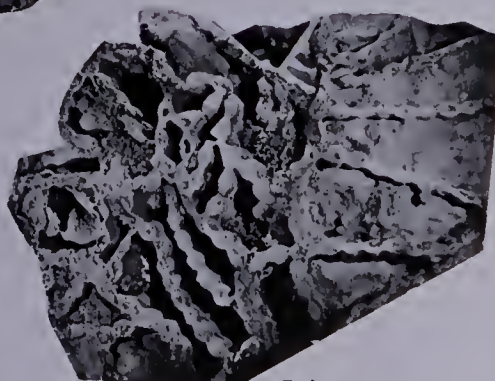
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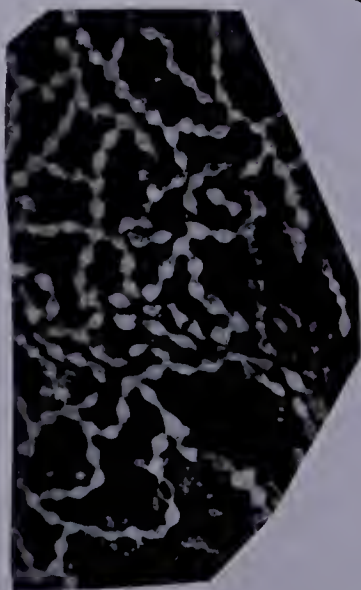
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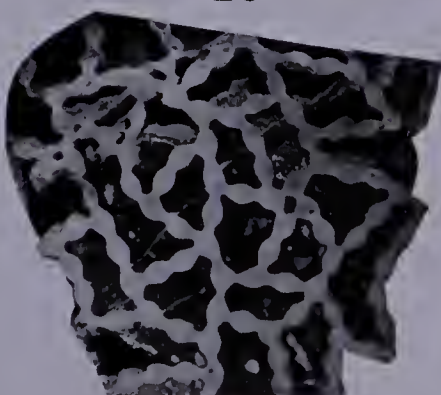
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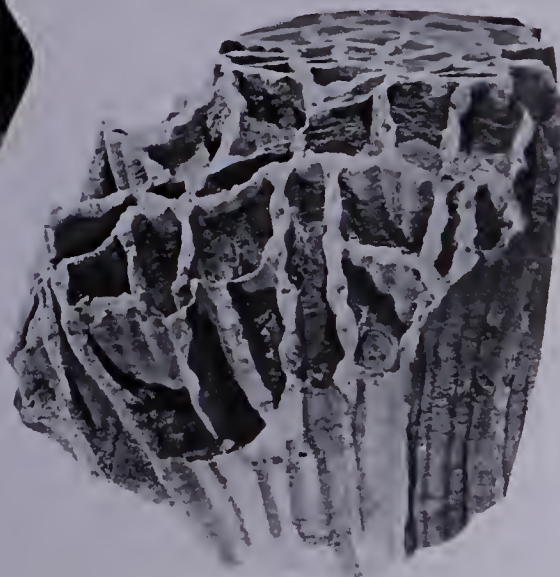
21



22



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24





PLATE XIX

Sandpile coralline member fauna

(Figures natural size unless otherwise stated)

Figures:

- 1,2. Undetermined tubular, tabulate coral, side views X2 and X4 showing lateral budding, ED 6537
- 3,4. Favositid coral, early stage of growth, 3 - top view of corallum, 4 - side view of corallum showing rounded rather than polygonal corallites, S 16327
- 5,6. aff. Syringopora sp. (3/4-1 mm. corallites, no tabulae seen), 5 - transverse section of corallum, 6 - lateral section of corallum, S 16024
7. Undetermined tubular, tabulate coral (1 1/2-2 mm. corallites, flat tabulae), lateral view of corallum, S 16319
- 8-10. Fletcheria deadwoodensis Norford, 8 - top view of corallum, 9 - enlarged view (X4) showing quadripartite corallite increase, 10 - lateral section of corallites showing tabulae, S 8455
- 11,12. Syringopora verticillata Goldfuss, 11 - side view of corallum, 12 - transverse section of corallum, S 16025
13. Striatopora sp. (1 mm. calyxes), lateral view of corallum (X2), ED 6538
- 14,16. Undetermined tabulate coral, 14 - transverse section (X2), 16 - lateral view (X2), ED 6537
15. Thamnopora sp., lateral view (X2) of corallum, S 8448
- 17,18. Heliolites sp. (1 mm. corallites), 17 - enlarged view (X4) of top of corallum, 18 - top view of corallum, S 8448
19. Propora sp. (2 mm. corallites), top view of corallum, S 8448
20. Heliolites sp. (1 1/4-1 1/2 mm. corallites), top view of corallum (X2), ED 65107
- 21-23. Favosites sp. (2 1/2-3 mm. corallites), 21 - enlarged view (X4) of a weathered specimen showing tabulae, 22 - top view of another corallum, 23 - longitudinal section of another corallum, S 8448
- 24,25. Palaeofavosites sp. (1 mm. corallites, 7-8 tabulae in 5 mm.), 24 - longitudinal section of corallum, 25 - transverse section of corallum, ED 6537
26. Favosites sp. (2 1/2 mm. corallites), basal view of corallum, S 8449
27. ?Favosites sp. (2 1/2 mm. corallites), top view of corallum (X2), ED 6537
- 28,29. ?Favosites sp. (1-1 1/2 mm. corallites), 28 - enlarged view (X15) of transverse section, 29 - transverse section (X2), S 8454

# PLATE XIX



1



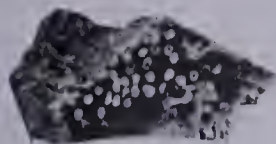
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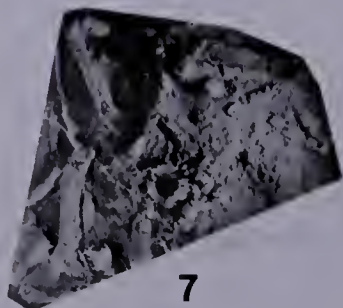
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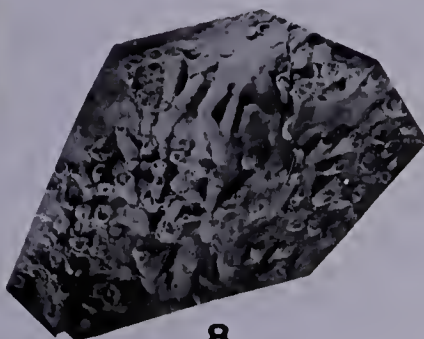
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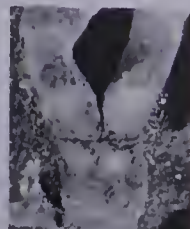
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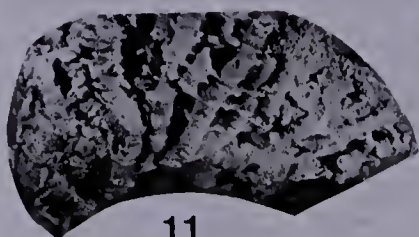
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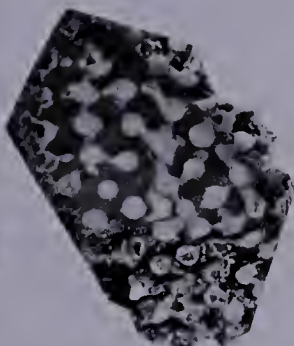
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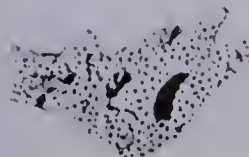
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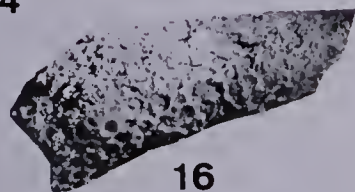
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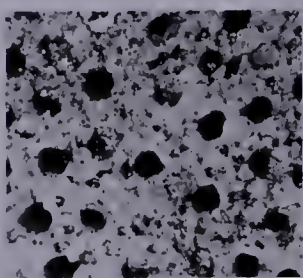
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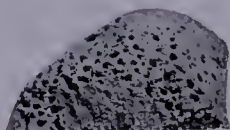
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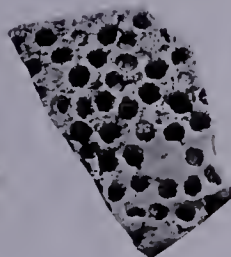
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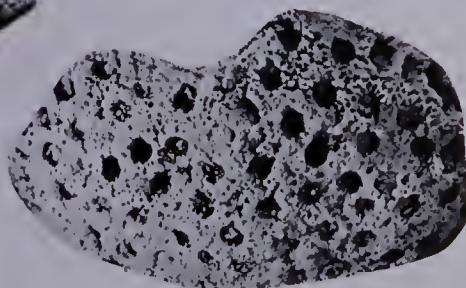
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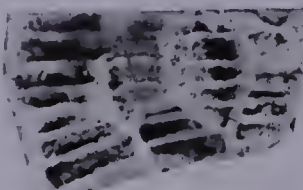
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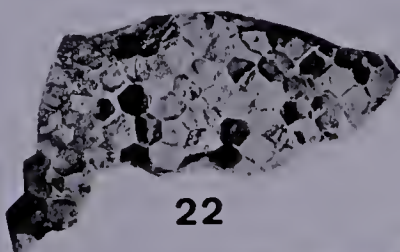
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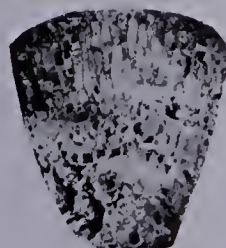
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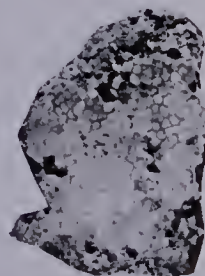
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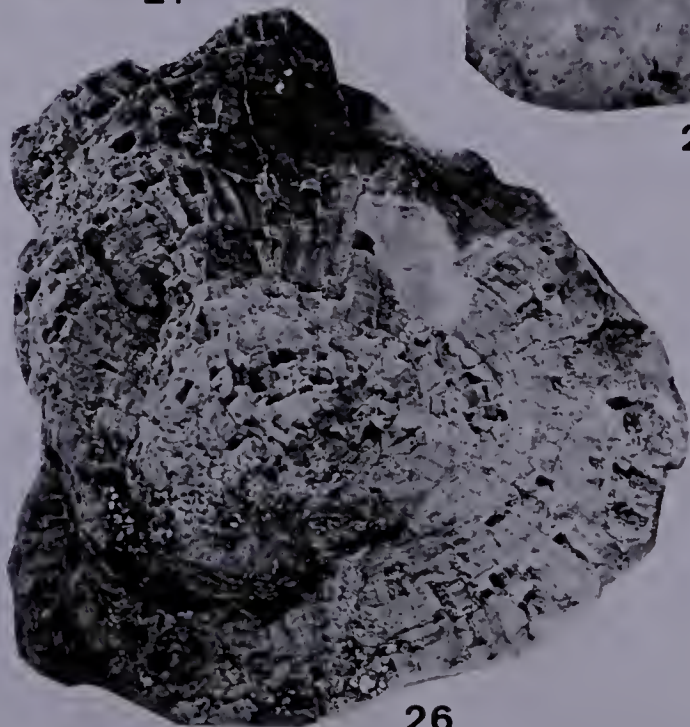
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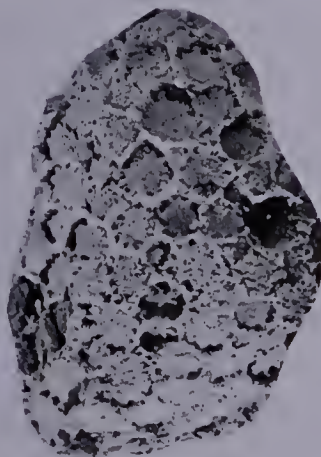
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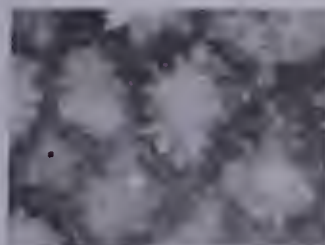
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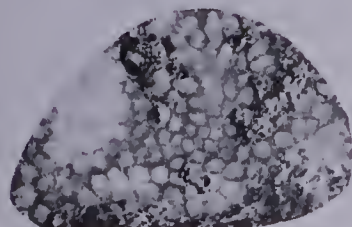
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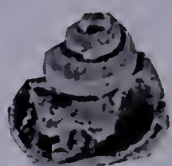


PLATE XX

Sandpile coralline member fauna

Figures:

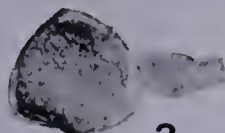
1. Lophospira sp., side view (X2), ED 6537
- 2,3. Euomphalus sp., 2 - basal view of part of outer whorl (X1), 3 - section of three whorls (X1), S 16025
- 4,5. ?Glassia sp., 4 - posterior view (X2), 5 - view of interior of pedicle valve, (X2), S 16327
- 6,7. Undetermined sponge, 6 - longitudinal section (X1), 7 - top view (X1), ED 65117
8. Undetermined sponge, basal view (X1), S 8448
9. Hormotoma sp., side view (X2), S 16025
- 10-14. Atrypa parva Hume, 10 - pedicle view, 11 - brachial view, 12 - side view, 13 - posterior view, 14 - anterior view, all X2, S 16328
- 15-18. Pentamerus sp., 15 - pedicle view, 16 - side view of pedicle valve, 17 - dorsal view of pedicle valve, all X1, S 16025
- 19,20. Undetermined rhynchonellid brachiopod, 19 - brachial view (X8), 20 - posterior view (X8), S 16025
- 21,22. Pentamerus sp., 21 - view of interior of pedicle valve X2, 22 - side view of pedicle valve (X2), S 16025
- 23,24. Undetermined rhynchonellid brachiopod, 23 - posterior view (X8), 24 - brachial view (X8), S 8455
- 25,26. Undetermined zygospirid brachiopod, 25 - brachial view (X8), 26 - posterior view (X8), S 16322
- 27-29. ?Hesperorthis sp., 27 - pedicle view, 28 - posterior view of pedicle valve, 29 - view of interior of pedicle valve, all X8, ED 6537



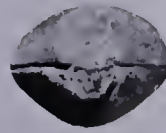
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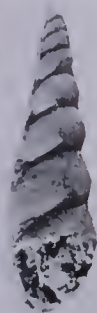
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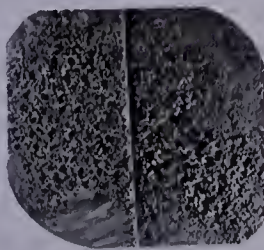
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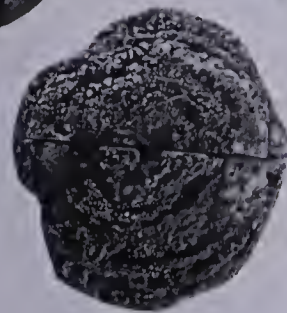
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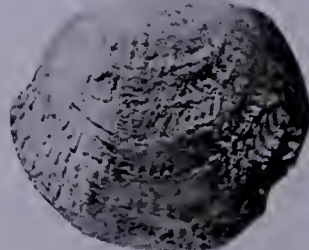
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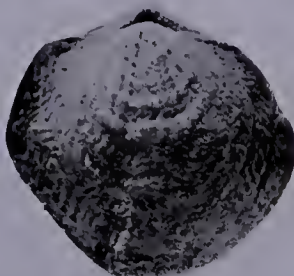
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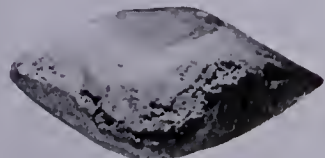
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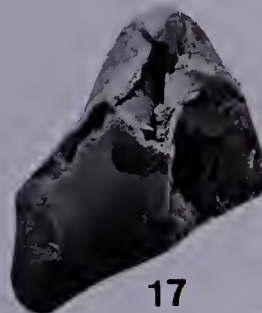
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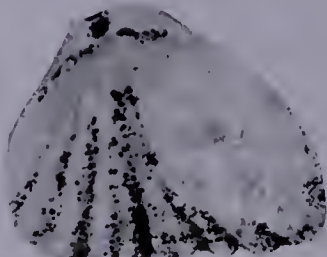
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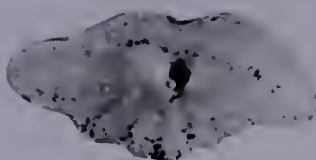
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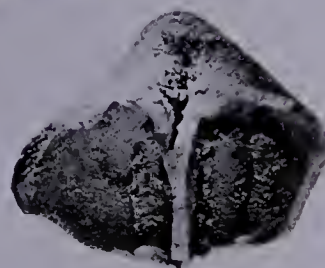
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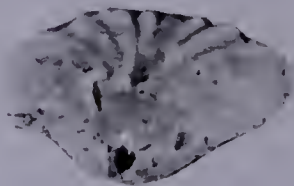
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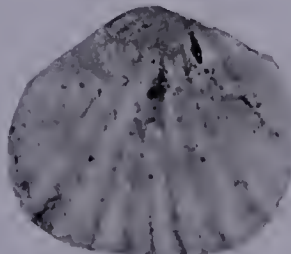
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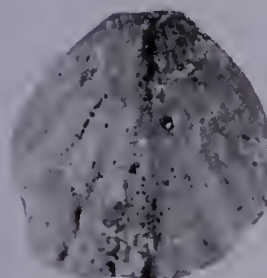
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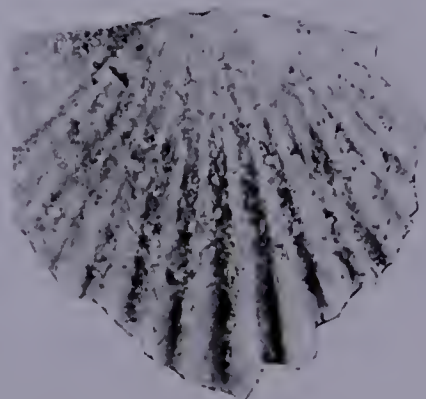
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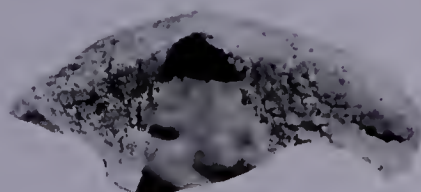
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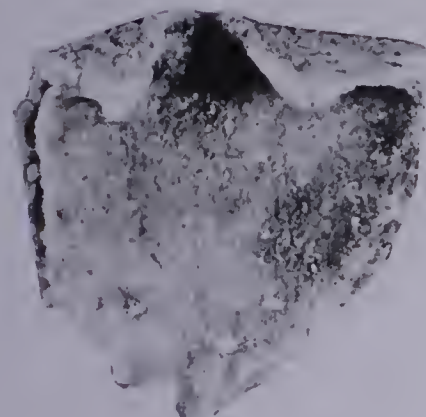
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PLATE XXI

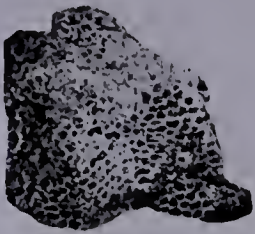
Silurian post-Sandpile coralline member fauna

(Figures natural size unless otherwise stated)

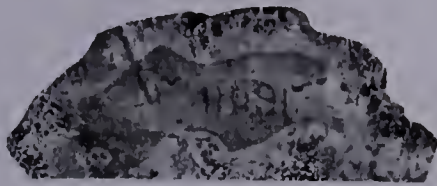
Figures:

- 1-3. Favosites sp. undet. (1 - 1 1/2 mm. corallites, 10 tabulae in 5 mm.) 1 - top view of corallum, 2 - longitudinal section of corallum, 3 - side view of corallum, showing mural pores (X4), S 16011
- 4, 8, 9. Undetermined lyssakid sponges (X2), GSC 65946
5. Craterophyllum aff. invaginatum (Davis), longitudinal section, ED 6575
- 6, 13. Fletcheria sp. (3 mm. corallites, 7 tabulae in 5 mm.), 6 - transverse section of corallite (X15), 13 - transverse section of corallum ED 6575
7. Favositid coral, top view of corallum (X2), S 16011
- 10, 11. ?Columnaria sp. (6 mm. corallites, very short septa), 10 - longitudinal section of corallum. Note quadripartite increase of corallites. ED 6575
- 12, 14. Favosites sp. undet. (1 1/2 mm. corallites, 10 tabulae in 5 mm.), 12 - longitudinal section of corallum, 14 - transverse section of corallum S 16138

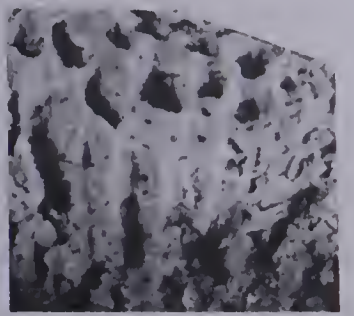
# PLATE XXI.



1



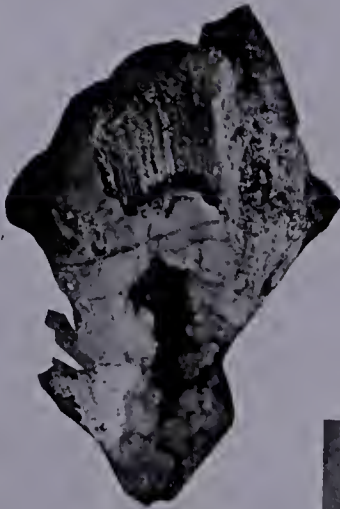
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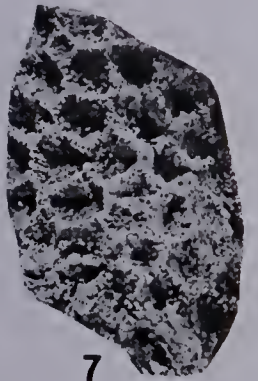
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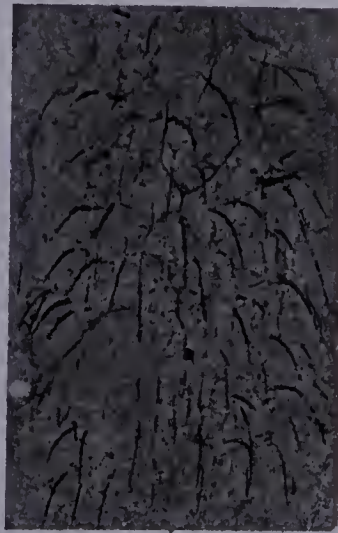
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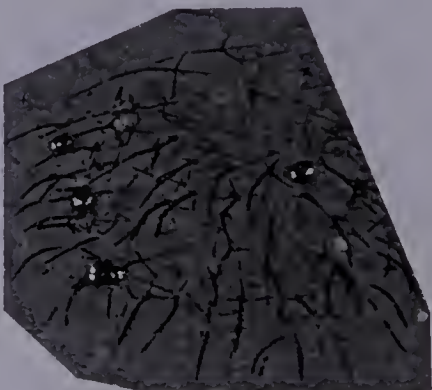
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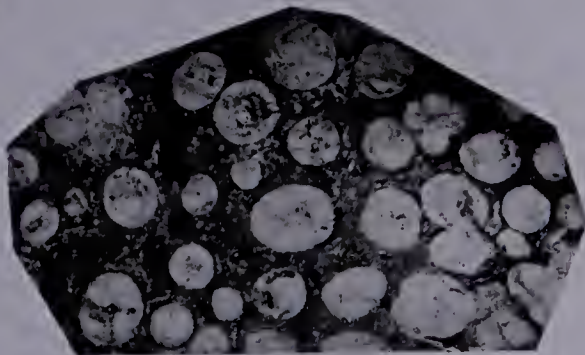
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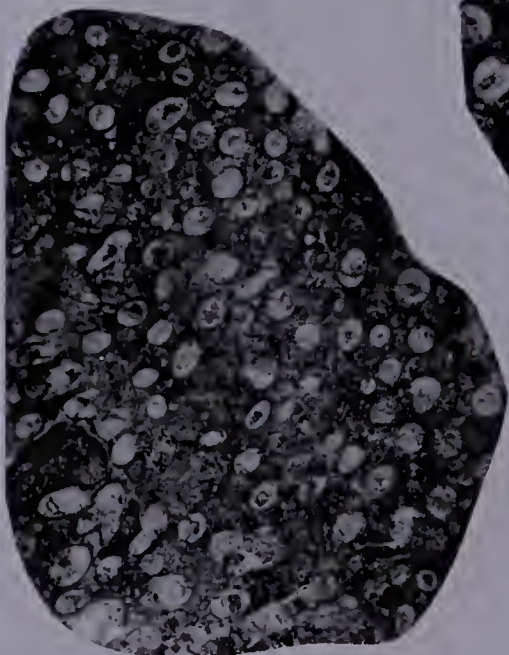
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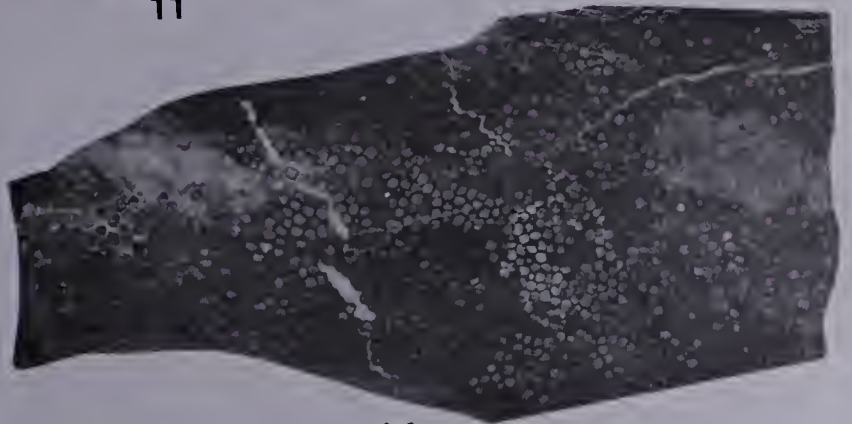
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14



## APPENDIX A

### Columnar Sections

#### Introduction

The format of the columnar sections, method of description, and abbreviations incorporate the most applicable features of several recommended styles. Standard lithologic symbols are used. Examples serve to illustrate the method of presentation which gives a visual quantitative estimate:

Lithologic symbols:		Sandstone, Quartzite
		Siltstone
		Shale (possesses some degree of fissility), mudstone.
		Limestone
		Dolomite
		Chert (nodules, bands, stringers)
		Pelletal dolomite
		Lithoclasts (dolomite in this case)
Examples:		Limestone, accessory clay
		Argillaceous limestone
		Calcareous mudstone
		Mudstone (shale), accessory lime
		Dolomite, accessory sand
		Dolomite, accessory silt
		Dolomitic sandstone
		Sandstone, accessory silt and dolomite

Rock colours are those in the Rock-Color Chart, distributed by the Geological



Society of America (1963).

Grain and crystal size classes are shown in the following table (abbreviations in brackets):

<u>GRAIN SIZE</u>		<u>CRYSTAL SIZE</u>	
	<u>Size in mm.</u>		
S	very coarse (vc gr) ----- 1	-----	very coarse (vcxine)
A	coarse (c gr) ----- 1/2	-----	coarse (cxine)
N	medium (m gr) ----- 1/4	-----	medium (mxine)
D	fine (f gr) ----- 1/8	-----	fine (fxine)
	very fine (vf gr) ----- 1/16	-----	very fine (vfxine)
S	coarse (c slt) ----- 1/32	-----	extremely fine (efxine)
I	medium (m slt) ----- 1/64		microcrystalline (microxine)
L	fine (f slt) -----	-----	
T	----- 1/256		cryptocrystalline (cryptoxine)
	CLAY		

Where recorded, the actual thickness of a bed is given in feet or inches.  
In other cases the following terms are used (abbreviations in brackets):

laminated (lam) less than 1/4"

thin bedded (thn bd) 1/4-2"

medium bedded (med bd) 2"-2'

thick bedded (thk bd) 2'-4'

very thick bedded (v thk bd) 4'-8'

massive bedded (mass bd) greater than 8'

Table 1. Summary of the results of the experiments.

Table 1

Table 1

Table 1

Experiment	Results	Conclusions
1. Effect of temperature on the rate of reaction	As temperature increases, the rate of reaction increases.	Temperature is a factor that affects the rate of reaction.
2. Effect of concentration on the rate of reaction	As concentration increases, the rate of reaction increases.	Concentration is a factor that affects the rate of reaction.
3. Effect of surface area on the rate of reaction	As surface area increases, the rate of reaction increases.	Surface area is a factor that affects the rate of reaction.
4. Effect of catalyst on the rate of reaction	The presence of a catalyst increases the rate of reaction.	Catalysts are substances that speed up the rate of reaction without being consumed.
5. Effect of pressure on the rate of reaction	As pressure increases, the rate of reaction increases.	Pressure is a factor that affects the rate of reaction.
6. Effect of light on the rate of reaction	Light has no effect on the rate of reaction.	Light is not a factor that affects the rate of reaction.
7. Effect of pH on the rate of reaction	As pH increases, the rate of reaction decreases.	pH is a factor that affects the rate of reaction.
8. Effect of solvent on the rate of reaction	The rate of reaction is highest in water.	Solvent is a factor that affects the rate of reaction.
9. Effect of stirring on the rate of reaction	Stirring increases the rate of reaction.	Stirring is a factor that affects the rate of reaction.
10. Effect of time on the rate of reaction	The rate of reaction decreases over time.	Time is a factor that affects the rate of reaction.

Table 2. Summary of the results of the experiments.

Table 2

- 1. Effect of temperature on the rate of reaction
- 2. Effect of concentration on the rate of reaction
- 3. Effect of surface area on the rate of reaction
- 4. Effect of catalyst on the rate of reaction
- 5. Effect of pressure on the rate of reaction
- 6. Effect of light on the rate of reaction
- 7. Effect of pH on the rate of reaction
- 8. Effect of solvent on the rate of reaction
- 9. Effect of stirring on the rate of reaction
- 10. Effect of time on the rate of reaction

## Abbreviations

alt	alternat (ing)	perp	perpendicular
arg	argillaceous	poss	possible (ly)
av	average (ing)	pt	part
bd	bed (s, ding, ded)	qtz	quartz
bl	blue (ish)	qtzitic	quartzitic
blk	black	qtzt	quartzite
br	brown	rd	rounded
brachs	brachiopods	recess	recessive
c	coarse	resist	resistant
c50'	about 50'	scatt	scattered
calc	calcareous	sd	sand
carb	carbonaceous	sdv	sandy
col	colour (s)	sh	shale
conglom	conglomerate	sli	slightly
cov	covered	slt	silt
cryptoxine	cryptocrystalline	sltst	siltstone
cxine	coarsely crystalline	slty	silty
diam	diameter	soln	solution
dk	dark	sort	sorting (ed)
dol	dolomite (ic)	splitt	splitting
efxine	extremely finely crystalline	ss	sandstone
exp	exposed (ure)	strat	stratigraphically
f	fine	subang	subangular
fiss	fissile	subrd	subrounded
foss	fossils (iferous)	thk	thick
fxine	finely crystalline	thn	thin
gast	gastropods	v	very
gn	greenish	vc	very coarse
gr	grains (ed)	vcxine	very coarsely crystalline
grap	graptolites (itic)	vf	very fine
gy	gray (ish)	vfxine	very finely crystalline
intbd	interbed (s, ded)	wh	white
intergran	intergranular	wth	weathers (ing, ed)
lam	lamination (s, ed)	X	cross
leach	leached	yel	yellow (ish)
lst	limestone		
lt	light		
m	medium (w.r.t. grain size)		
mass	massive		
med	medium(w.r.t. bedding)		
microxine	microcrystalline		
mod	moderate (ly)		
mudst	mudstone		
mxine	medium crystalline		
nods	nodules		
occ	occasional (ly)		
ol	olive		
or	orange		
org	organic		



Figure 6

SECTION: NORTH CHESTERFIELD LAKE

LOCATION: 57° 44'N, 125° 07'W

Measured down creek flowing southwards into  
the western end of Chesterfield Lake.

MEASURED BY: Author and D. Stelck in 1964.

MICROLOGGED BY: Author in 1965.

STRATIGRAPHIC SUMMARY:

Sandpile Group (incomplete).....	100'
Cloudmaker Formation (lower shale and siltstone member).....	1480'
Mount April Formation (incomplete).....	2170'

Section overlain by about 1000' of Sandpile siltstones.  
Base of section at lower limit of exposure.

REMARKS: Thickness of covered interval between 128'  
and 870' measured by trigonometrical method.  
Slight discordance in dip of beds limits  
accuracy in this case to 15%.

2294-2346' Conotrata sp.,  
bellerophontid gastropods,  
Robsonoceras sp.,  
Shumardia sp., ?pliomierid.  
(CANADIAN)

3050' (Float) Conotrata  
sp., Matherellina sp.,  
aff. Megalomphala sp.,  
Robsonoceras sp., ?Malcott-  
oceras sp., Shumardia sp.,  
Protopliomerops sp., ?Isotel-  
oides sp. (CANADIAN)

3426-38' Elkania sp., aff.  
Pseudobolus sp., ?Ophileta  
sp., ?Matherellina sp.,  
?Schizopea sp., aff. Meg-  
alomphala sp., Tropido-  
discus sp., Robsonoceras  
sp., cf. Ventrioloboceras  
sp., ?Geragnostus sp.,  
Hystricurus sp., Apachkeph-  
alus sp., Shumardia sp.,  
protopliomerid, bryozoan,  
echinoderm fragments.  
(CANADIAN)  
3456-3510' Elkania sp.,  
Lytopspira sp., aff. Meral-  
omphala sp., Robsonoceras

2066-2246  
vague lam, calcite veins, one 3' bd.  
Sh with nodular calc mudst bands as 1903-2063'.  
The v thin calc lam in the sh become less common  
downwards with the result that the sh is non-calc  
near the base of the interval. Thk calcite veins  
near the base of the interval.

2246-2294  
Sh with nodular calc bands. Sh, med dk gy, wth br  
gy, v thin calc lam, in bands av 3" thk. Calc mudst,  
med lt gy, wth lt br gy, 30-40% microxine lime, in  
nodular bands av 5/8" thk. Interval cleaved, rocks  
break perp to bd, cliff-forming, mass bd.  
2294-2308  
Sh with nodular calc mudst bands as 2246-2294'.  
with minor lst. Lst, med gy, wth lt br gy, micro-  
xine, 20-25% m-c silt, scatt lithoclasts of buff wth  
lam lst, scatt chitinous org debris, few calcite  
veins, one 18" bd at 2294' and one 6" bd at 2307.5'.  
2308-2346  
Sh with nodular calc mudst bands as 2246-2294'.  
Much calcite veining and some poor lst development.  
2346-2369  
Sh with nodular calc mudst bands. Sh, med dk gy,  
wth lt br gy, in bands 3" thk. Calc mudst, med lt  
gy, wth lt br gy, 30-40% microxine lime, in bands  
3/8" thk. Interval cleaved, rocks break perp to bd,  
cliff-forming, mass bd. At 2358.5' there is a 6"  
bd of lst (lst same as 2294-2295.5').

2369-2569  
Sh with nodular calc mudst bands. Sh, med dk gy,  
wth lt br gy, v thin calc lam, in bands 3" thk. Calc  
mudst, med lt gy, wth lt br gy, 30-40% microxine  
lime, in nodular bands 1" thick. Interval cleaved,  
rocks break perp to bd, cliff-forming, mass bd.  
2569-2713  
Sh with nodular calc mudst bands as 2369-2569' but  
sh does not have calc lam, mostly resist but sli  
recess in pt.

2713-3071  
Sh with nodular calc mudst bands as 2369-2569' but  
sh in bands 5" thk, sli recess in pt.

3071-3218  
Sh, med dk gy to dk gy, wth lt br gy, v thin calc  
lam, rare bands of nodular calc mudst, cleaved,  
breaks perp to bd, relatively recess, poor exp,  
mass bd.

3218-3283  
Recess, cov.

3283-3289  
Sh as 3071-3218'.  
3289-3426  
Recess, cov.

3426-3438  
Lst, med gy with bl tinge to med dk gy, wth med gy  
to lt ol gy, cryptoxine-microxine, up to 40% silt,  
up to 10% clay, up to 30% chitinous org debris,  
total residue less than 50%, pyritic, secondary  
silica, splintery, resist, no visible bd. Some  
minor sh as 3071-3218'.  
3438-3456  
Cov.  
3456-3473  
Lst as 3426-3438'.  
3473-3500  
Cov.  
3500-3528  
Lst as 3426-3438'. Passes downwards with gradation-  
al contact into sh as 3071-3218' which has 1" thk  
nodular bands of calc mudst at 5" intervals.  
3528-3545  
Cov.  
3545-3582  
Intbd lst and sh. Lst as 3426-3438'. Sh as in 3500-  
3528'.  
3582-3750  
Sh as in 3500-3528'.

Age	Rock unit	Footage	Litholog	Lithological descriptions	Fossils and Age
Silurian	Sandpile			0-15 Qtzt, lt med gy, wth same, m-c gr, subrd, some overgrowths, mod sort, trace dol, resist, mass bd.	50' (Talus) <u>Monograptus</u> sp. (SILURIAN)
				15-90 Cov.	
		100		90-100 Breccia, lt med gy, wth same, irregular lithoclasts of slty dol and dol sltst, matrix slt with 10% clay and 10% dol, coral and crinoidal debris, thin-med bd.	
				100-120 Cov.	
		200		120-128 Sh, dk gy, wth med gy, wth surface largely cov by sulphur bloom, sli slty, grap, fiss.	
				128-870 Cov. Generally recess with few showings of sh, slty sh and sltst	
		300			
		400			
		500			
		600			
Cloudmaker Formation		700			120-28' <u>Glyptograptus</u> sp.
		800			
		900		870-872 Dol, med gy with deep bl tinge, wth same, efxine-vfxine, 10% slt, scatt blk chert nodules, hard, resist, one 2' bd.	
				872-964 Recess, cov.	
		1000		964-972 Dol, med gy, wth lt br gy, mxine, 10% slt, 5% clay, reworked and might almost be classed a penecontemporaneous breccia, v hard, v resist, cliff-forming, lumpy bd plane, bd 2'-4'. Minor thin arg sltst bds.	
				972-987 Dol, med gy, wth lt br gy to lt gy, medxine, 15% slt, scatt dk bl nodules of chertified dol, reworked, v hard, v resist, cliff-forming, mass bd.	
		1100		987-989 Sltly sh and arg sltst, dk gy, wth dk gy to br gy, grap, recess, fiss.	
				989-1004 Dol, med dk gy, wth lt br gy to lt gy, abundant lithoclasts up to 2" long of lam buff wth dol which has 20% slt and clay, matrix dk bl chertified dol, v hard, v resist, mass bd.	
		1200		1004-1058 Sltst, med dk gy, wth dk br gy, grap, recess, thn bd.	
				1058-1095 Intbd dol and sltst in ratio 3:1. Dol as 989-1004 but v thk-mass bd. Sltst as 1004-1058.	
				1095-1183 Dol as 989-1004. Base cliff-forming unit.	
				1183-1235 Recess, cov.	
		1300		1235-1244 Calc mudst, dk gy, wth med dk gy, 10% slt, 20-30% microxine-efxine lime, faint lam, scatt small nodules of chertified lst, thn bd.	
				1244-1304 Cov.	
		1400		1304-1320 Sltst, fresh colour not seen, wth ol gy with some or gy spotting, silt f-m, trace dol in pt, grap, blocky, thn bd. Few intbds of qtzt, med gy with bl tinge, wth same to br gy, vf-m gr, v hard, 4" bd.	
				1320-1392 Cov.	
		1500		1392-1408 Sh, dk gy, wth med gy to lt br gy, v sli slty, calc in pt, grap, blocky to fiss, thn bd.	
				1408-1445 Cov.	
		1500		1445-1448 Sh, dk gy, wth med gy to lt br gy, trace silt, sli calc in pt, grap, wth to give large blocks which have slumped, fiss in pt, thin bd.	
				1448-1457 Cov.	
		1600		1457-1482 Calc mudst, med dk gy, wth yel gy to med gy, 10-50% microxine-efxine lime, fine lam reflect the variation in lime content, resist, mass bd.	
				1482-1569 Cov.	
		1700		1569-1571 Sh, fresh colour not seen, wth br gy, cleaved and breaks perp to bd, grap.	
				1571-1580 Cov.	
		1800		1580-1618 Arg dol, med gy, wth lt br gy, efxine, variable lime content, 35% br clay, calcite veining, med to thk bd. Top of cliff-forming unit.	
				1618-1713 Calc mudst, med dk gy, wth to give alt gy and yel gy bands, 30-50% microxine lime, lam reflect variation in lime content, pyritic in pt, hard, splintery, blocky near top, bd thk-mass, rarely thn-med. Base cliff-forming unit	
		1800		1713-1723 Sh, med dk gy, wth med gy, sli calc, breaks easily, recess.	
				1723-1876 Cov.	
Ordovician		1900		1876-1903 Sh, shining med gy, wth med dk gy, rexised wh slt lam which wth or br and are up to 1/10" thk, these lam make up 1/6 of the rock and give it a lined	987-89' <u>Cryptograptus</u> sp., <u>Glyptograptus euglyphus</u> (Lapworth), <u>Isograptus forcipiformis</u> (Ruedemann), <u>dichograptid</u> , <u>caryocarid</u> . (ZONE OF PARAGLOSSOGRAPTUS ETHERIDGEI) 1004-58' <u>Tetragraptus</u> sp.  1304-20' <u>Amplexograptus confertus</u> , <u>Cryptograptus antennarius</u> , C. sp. A, <u>Dichograptus</u> spp., <u>Didymograptus enodus</u> , ?D. <u>robustus</u> , D. sp., <u>Glossograptus</u> sp., <u>Cryptograptus teretiusculus</u> , <u>Isograptus</u> cf. <u>caduceus</u> , <u>nanus</u> , <u>Paraglossograptus etheridgei</u> , ? <u>pseudodichograptus confertus</u> , <u>Tetragraptus bigsbyi</u> var. <u>latus</u> , T. aff. <u>pendens</u> , T. spp., ? <u>Trionocraptus</u> , <u>caryocarid</u> , <u>brachiopod</u> (ZONE OF PARAGLOSSOGRAPTUS ETHERIDGEI) 1392-1408' <u>Dichograptus</u> cf. <u>octobrachiatus</u> , D. spp., <u>Didymograptus</u> aff. <u>extensus</u> , D. aff. <u>nitidus</u> , D. <u>procumbens</u> , <u>Isograptus caduceus</u> , <u>divergens</u> , I. g. <u>maximo-divergens</u> , I. spp., <u>Phyllograptus</u> aff. <u>angustifolius</u> , <u>Tetragraptus</u> sp., <u>caryocarid</u> . (ZONE OF ISOGRAPTUS CADUCEUS) 1445-48' (Talus) <u>Dichograptus</u> cf. <u>marathonensis</u> , D. cf. <u>octobrachiatus</u> , D. spp., <u>Didymograptus</u> aff. <u>extensus</u> , D. aff. <u>nitidus</u> , D. sp., <u>Isograptus caduceus</u> , <u>divergens</u> , I. g. <u>maximo-divergens</u> , I.



Figure 7

SECTION: NORTH AKIE RIVER

LOCATION: 57° 21' 30"N, 124° 34' 30"W.

Peak two miles southeast of a small unnamed lake on the north side of Akie River..

MEASURED BY: Pan American Petroleum Corporation in 1961.

STRATIGRAPHIC SUMMARY:

Sandpile Group (incomplete).....815'

Cloudmaker Formation (total thickness 1255'):

upper shale and siltstone member.....80'

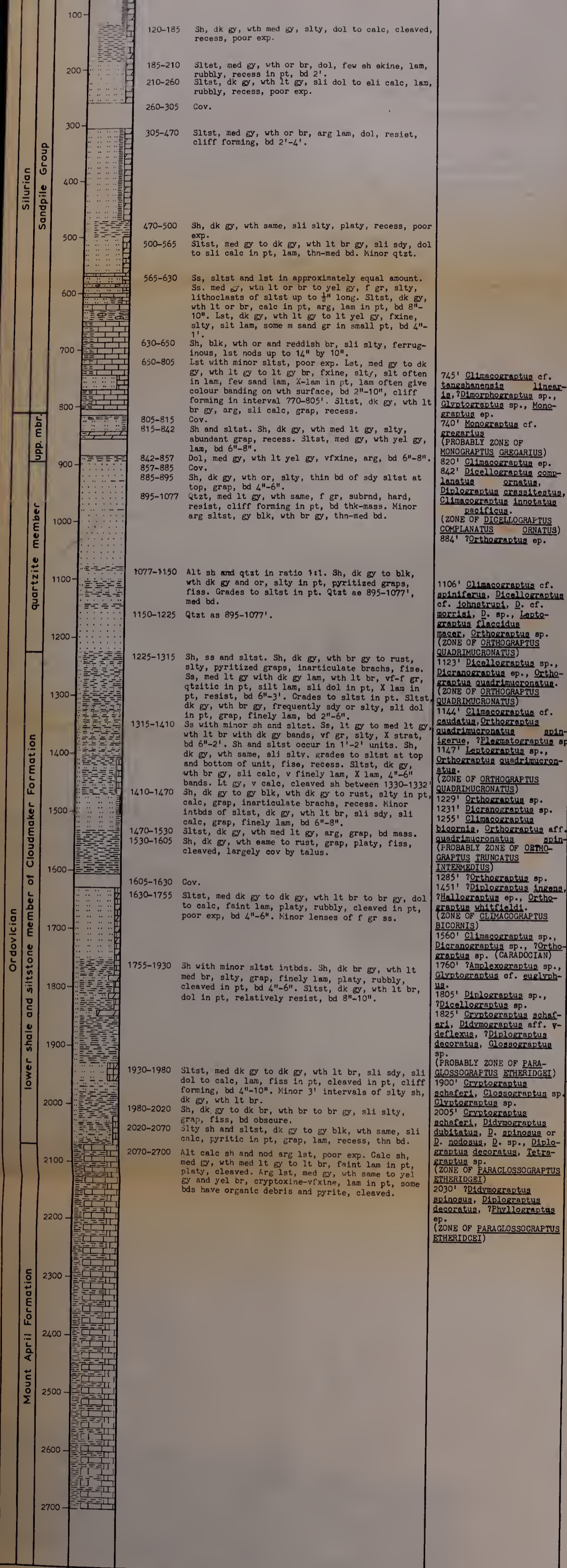
quartzite member.....330'

lower shale and siltstone member.....845'

Mount April Formation (incomplete).....590'

Summit of peak is top of section. Section underlain by an estimated 800' of Mount April argillaceous limestones.

REMARKS: This section was published by Jackson, Steen, and Sykes in 1965.



Age	Rock unit	Footage	Litholog	Lithological descriptions	Fossils and Age
Silurian	Sandpile Group			0-120 Sltst, dk gy, wth lt br to or br, arg and fiss in pt, sli sdy in pt, dol, worm borings, lam and X-lam, splitting planes 1"-4" apart, bd 1'-3'.	
		100		120-185 Sh, dk gy, wth med gy, slty, dol to calc, cleaved, recess, poor exp.	
		200		185-210 Sltst, med gy, wth or br, dol, few sh skins, lam, rubbly, recess in pt, bd 2'.	
				210-260 Sltst, dk gy, wth lt gy, sli dol to sli calc, lam, rubbly, recess, poor exp.	
				260-305 Cov.	
		300		305-470 Sltst, med gy, wth or br, arg lam, dol, resist, cliff forming, bd 2'-4'.	
		400			
		500		470-500 Sh, dk gy, wth same, sli slty, platy, recess, poor exp.	
				500-565 Sltst, med gy to dk gy, wth lt br gy, sli sdy, dol to sli calc in pt, lam, thn-med bd. Minor qtzt.	
		600		565-630 Ss, sltst and lst in approximately equal amount. Ss. med gy, wth lt or br to yel gy, f gr, slty, lithoclasts of sltst up to ½" long. Sltst, dk gy, wth lt or br, calc in pt, arg, lam in pt, bd 8"-10". Lst, dk gy, wth lt gy to lt yel gy, fxine, slty, slt lam, some m sand gr in small pt, bd 4"-1'.	
upp. mbr.	quartzite member	700		630-650 Sh, blk, wth or and reddish br, sli slty, ferruginous, lst nods up to 14" by 10".	
				650-805 Lst with minor sltst, poor exp. Lst, med gy to dk gy, wth lt gy to lt gy br, fxine, slty, slt often in lam, few sand lam, X-lam in pt, lam often give colour banding on wth surface, bd 2"-10", cliff forming in interval 770-805'. Sltst, dk gy, wth lt br gy, arg, sli calc, grap, recess.	
				805-815 Cov.	
				815-842 Sh and sltst. Sh, dk gy, wth med lt gy, slty, abundant grap, recess. Sltst, med gy, wth yel gy, lam, bd 6"-8".	745' <i>Climacograptus</i> cf. <i>tangshanensis</i> <i>linearis</i> , ? <i>Dimorphograptus</i> sp., <i>Glyptograptus</i> sp., <i>Monograptus</i> sp.
		900		842-857 Dol, med gy, wth lt yel gy, vfxine, arg, bd 6"-8".	740' <i>Monograptus</i> cf. <i>gregarius</i> (PROBABLY ZONE OF <i>MONOGRAPTUS GREGARIUS</i> )
				857-885 Cov.	820' <i>Climacograptus</i> sp.
				885-895 Sh, dk gy, wth or, slty, thin bd of sdy sltst at top, grap, bd 4"-6".	842' <i>Dicellograptus complanatus ornatus</i> , <i>Diplograptus crassitatus</i> , <i>Climacograptus innotatus pacificus</i> .
				895-1077 Qtzt, med lt gy, wth same, f gr, subrnd, hard, resist, cliff forming in pt, bd thk-mass. Minor arg sltst, gy blk, wth br gy, thn-med bd.	(ZONE OF <i>DICELLOGRAPTUS COMPLANATUS ORNATUS</i> )
		1000			884' ? <i>Orthograptus</i> sp.
		1100		1077-1150 Alt sh and qtzt in ratio 1:1. Sh, dk gy to blk, wth dk gy and or, slty in pt, pyritized graps, fiss. Grades to sltst in pt. Qtzt as 895-1077', med bd.	1106' <i>Climacograptus</i> cf. <i>spiniferus</i> , <i>Dicellograptus</i> cf. <i>johnstrupi</i> , D. cf. <i>morrisi</i> , D. sp., <i>Leptograptus flaccidus</i>
Ordovician	nd siltstone member of Cloudmaker Formation			1150-1225 Qtzt as 895-1077'.	<i>macer</i> , <i>Orthograptus</i> sp. (ZONE OF <i>ORTHOGRAPTUS QUADRIMUCRONATUS</i> )
		1200		1225-1315 Sh, ss and sltst. Sh, dk gy, wth br gy to rust, slty, pyritized graps, inarticulate brachs, fiss. Ss, med lt gy with dk gy lam, wth lt br, vf-f gr, qtztic in pt, silt lam, sli dol in pt, X lam in pt, resist, bd 6"-3'. Grades to sltst in pt. Sltst, dk gy, wth br gy, frequently sdy or slty, sli dol in pt, grap, finely lam, bd 2"-6".	1147' <i>Leptograptus</i> sp., <i>Orthograptus quadrimucronatus</i>
		1300		1315-1410 Ss with minor sh and sltst. Ss, lt gy to med lt gy, wth lt br with dk gy bands, vf gr, slty, X strat, bd 6"-2'. Sh and sltst occur in 1'-2' units. Sh, dk gy, wth same, sli slty, grades to sltst at top and bottom of unit, fiss, recess. Sltst, dk gy, wth br gy, sli calc, v finely lam, X lam, 4"-6" bands. Lt gy, v calc, cleaved sh between 1330-1332'	1144' <i>Climacograptus</i> cf. <i>caudatus</i> , <i>Orthograptus quadrimucronatus spinigerus</i> , ? <i>Platystrophia</i> sp., <i>Leptograptus</i> sp., <i>Orthograptus quadrimucronatus</i>
		1400		1410-1470 Sh, dk gy to gy blk, wth dk gy to rust, slty in pt, calc, grap, inarticulate brachs, recess. Minor intbds of sltst, dk gy, wth lt br, sli sdy, sli calc, grap, finely lam, bd 6"-8".	(ZONE OF <i>ORTHOGRAPTUS QUADRIMUCRONATUS</i> )
		1500		1470-1530 Sltst, dk gy, wth med lt gy, arg, grap, bd mass.	1229' <i>Orthograptus</i> sp.
				1530-1605 Sh, dk gy, wth same to rust, grap, platy, fiss, cleaved, largely cov by talus.	1231' <i>Dicranograptus</i> sp.
		1600			1255' <i>Climacograptus bicornis</i> , <i>Orthograptus</i> aff. <i>quadrimucronatus spinigerus</i> (PROBABLY ZONE OF <i>ORTHOGRAPTUS TRUNCATUS INTERMEDIUS</i> )
				1605-1630 Cov.	1285' ? <i>Orthograptus</i> sp.
				1630-1755 Sltst, med dk gy to dk gy, wth lt br to br gy, dol to calc, faint lam, platy, rubbly, cleaved in pt, poor exp, bd 4"-6". Minor lenses of f gr ss.	1451' ? <i>Diplograptus ingens</i> , ? <i>Hallograptus</i> sp., <i>Orthograptus whitfieldi</i> . (ZONE OF <i>CLIMACOGAPTUS BICORNIS</i> )
		1700			1560' <i>Climacograptus</i> sp., <i>Dicranograptus</i> sp., ? <i>Orthograptus</i> sp. (CARADOCIAN)
		1800		1755-1930 Sh with minor sltst intbds. Sh, dk br gy, wth lt med br, slty, grap, finely lam, platy, rubbly, cleaved in pt, bd 4"-6". Sltst, dk gy, wth lt br, dol in pt, relatively resist, bd 8"-10".	1760' ? <i>Amplexograptus</i> sp., <i>Glyptograptus</i> cf. <i>euzephyus</i> . 1805' <i>Diplograptus</i> sp., ? <i>Dicellograptus</i> sp. 1825' <i>Graptograptus schef-</i>



Figure 8

SECTION: SOUTH CALNAN CREEK COMPOSITE

LOCATION: Measured in four parts on the south side of Calnan Creek.

Part 1 (0-1463'): 56° 50' 40"N, 123° 42' 15"W to  
56° 50' 25"N, 123° 41' 35"W.

Part 2 (1463-2485'): 56° 49' 50"N, 123° 43' 30"W to  
56° 49' 40"N, 123° 42' 45"W.

Part 3 (2485-4195'): 56° 49' 15"N, 123° 47' 00"W to  
56° 49' 50"N, 123° 45' 45"W.

Part 4 (4195-5650'): 56° 50' 05"N, 123° 43' 45"W to  
56° 50' 20"N, 123° 43' 45"W.

MEASURED BY: Author and W. Marsh in 1965.

MICROLOGGED BY: Author in 1965.

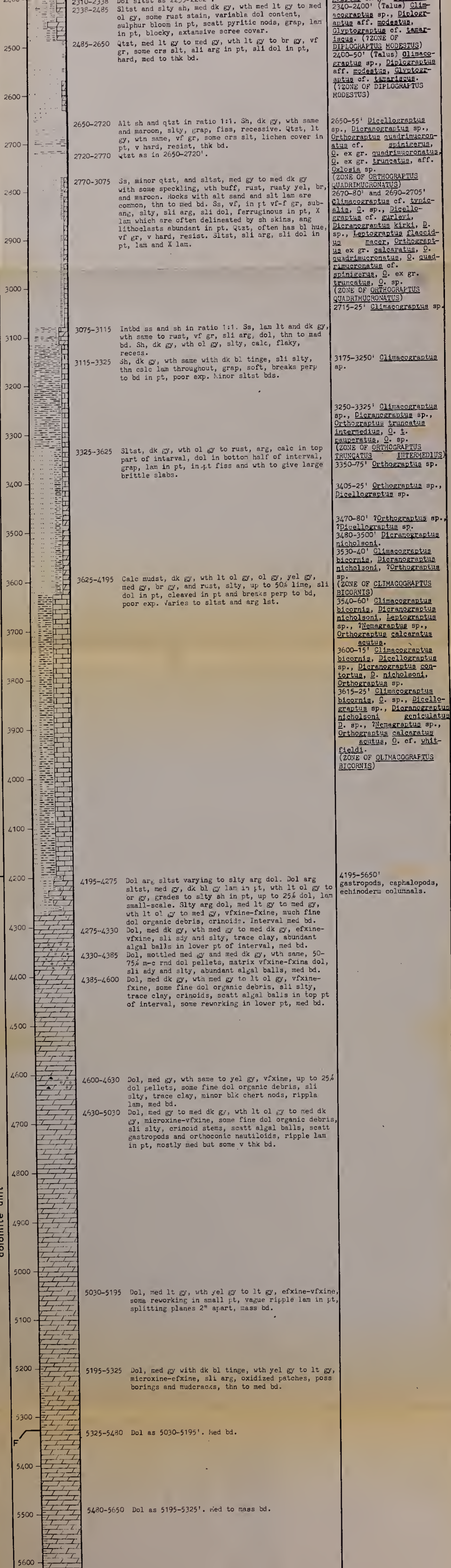
STRATIGRAPHIC SUMMARY:

Silurian siltstone unit.....1463'  
Silurian dolomite unit.....367'  
Silurian (and Ordovician?) mudstone unit.....655'  
Cloudmaker Formation:  
quartzite member.....285'  
lower shale and siltstone member.....1425'  
Ordovician dolomite unit (incomplete).....1130'

Silurian siltstone unit is overlain by Devonian sandy dolomite. Base of section at lower limit of exposure.

REMARKS: The parts of the section were accurately composited at marked lithological breaks.

A thrust fault is probably present at 5325' and section below this footage is probably repetitive.



Age	Rock unit	Footage	Litholog	Lithological descriptions	Fossils and Age
Silurian	siltstone unit			0-80 Siltst, dk gy, wth same to ol gy, dol, trace clay, scatt rusty specks, med bd. Few med bds of lst, dk gy, wth med gy, microxine, arg in pt, corals, crinoids.	
		100		80-145 Sltly lst, dk gy, wth med gy to ol gy, microxine, 25-50% silt, 10-20% clay, crinoids, lam in pt, breaks perp to bd, med bd. One med bd of lst, dk gy, wth med gy, microxine, scatt subrnd f-m qtz gr, trace silt, trace clay, corals, crinoids.	
		200		145-272 Ss, med dk gy to dk gy, wth ol gy, vf gr, subrnd, slty, arg, calc, trace dol, lam in pt giving faint colour banding on wth surface, med bd.	200' (Talus -from this unit) Favosites sp.
		300		272-358 Ss, med dk gy to br gy, wth med dk gy, vf-f gr, subrnd, grades into sdy siltst in pt, minor siltst intbds, trace clay in pt, calc in pt, scatt clay specks give peppery appearance in pt, med bd.	
		400		358-449 Calc siltst, med dk gy to dk gy, wth same to ol gy, sli arg, sli sdy in pt, lam med bd.	400' (Talus) Crinoid columnals.
		500		449-464 Lst, br gy, wth med ol gy, microxine, trace silt, trace clay, crinoid stems, corals, med bd.	
				464-689 Siltst, dk gy, wth br gy, calc, up to 50% f sand, up to 50% clay, lam, fiss to platy in pt, med bd.	
		600			
		700		689-832 Lst, med dk gy to dk gy, wth br gy, microxine, slty, arg, grades to calc siltst and calc slty sh in pt, some bds have scatt rnd m sand gr, crinoids, fiss to platy, med bd.	
		800			
Silurian	siltstone unit	900		832-1192 Dol siltst, med dk gy to dk gy, wth rust to yel br, sli arg, lam, worm burrows common, platy to fiss, v poorly exp, thn to med bd.	
		1000			
		1100			
		1200		1192-1225 Sh, dk gy, wth yel br, slty, calc in pt, v platy, thn bd.	
				1225-1262 Dol siltst as 832-1192' with rare graps.	
		1300		1262-1263 Dol, med dk gy, wth br gy, microxine, trace silt, trace clay, chertified in pt, 1' bd.	
				1263-1301 Dol siltst, lt br gy, wth same, up to 50% vf-f sand, sdy bds are qtzitic, worm burrows, vague grading in some bds, hard, resistant, thn to med bd.	
		1400		1301-1463 Dol siltst, med dk gy to dk gy, wth rust to yel br, arg in pt, abundant sh skins in pt, worm burrows, lam, recess, thn to med bd.	
		1500		1463-1500 Alt sdy dol and dol mudst. Sdy dol, med lt gy to med gy, wth same, microxine, vf-c rnd sand gr, sand often occurs in lenses which are sometimes X strat, hard, blocky, resist, v thk to mass bd. In pt grades to dol ss. Dol mudst, med dk gy, wth dk gy, platy, thn bd.	1468' brachiopod, sponges. 1488' Halysites of. sand- pilenia Norford (PROBABLY Llandoveryian) 1518' crinoid columnals.
		1600		1500-1540 Alt dol and dol mudst. Dol, med lt gy to med gy, wth same, microxine, abundant dol lithoclasts up to 8" long, lithoclasts elongate and parallel to bd, much crinoidal debris, some encrinite bands up to 4" thk, trace silt and br clay, minor chert nod, silicified fossils - mostly corals, hard, resist, v thk to mass bd. Dol mudst as in 1463-1500' with some vague ripple lam, in units 10-15' thk.	
Silurian	dolomite unit	1700		1540-1575 Dol as in 1500-1540'. Mass bd.	
				1575-1595 Arg dol, med dk gy to dk gy, wth same, microxine, some macerated fossil debris in pt, sli slty, faint banding.	1687' Favosites sp.
		1800		1595-1733 Dol, med dk gy to dk gy, wth med gy, microxine, abundant elongate and subang lithoclasts of arg dol up to 1' long, some crinoidal debris, trace clay, some irregular chert nod, silicified corals, hard, resist, v thk to mass bd.	1730' Heliolites sp., solitary coral. (SILURIAN)
		1900		1733-1795 Arg dol, dk gy, wth med dk gy, microxine, slty lam, med bd. Grades into dol mudst, fisa, platy, thn bd. Interval has 1" bd of encrinite, med dk gy, wth med gy, arg lam, some vf sand, sli slty, abundant silica replacement, pyritic.	
		2000		1795-1821 Arg dol, dk gy, wth same, microxine, trace silt, crinoidal at base, abundant irregular blk chert nod, "pinch and Swell" med bd. Grades into two 3' bands of intraformational conglom which have arg dol lithoclasts up to 3" long. Interval has minor dol sh intbds which are sulphurous.	
		2100		1821-1830 Mudst, med gy and dk gy lam, wth yel gy and med gy, distinctive banding, dol in pt, sli calc, some f silt, lam reflect variation in dol content, flaggy, v well bd - thn to med.	2050-2200 (Talus) Climacograptus sp., ?Orthograptus sp., ?Glyptograptus sp. (LLANDOVERYAN)
				1830-1860 Dol as 1595-1733'.	
		2200		1860-1895 Arg carbonate, med dk gy, wth same to med gy, more lst than dol, does not split parallel to bd, thn to med bd.	
				1895-2175 Calc slty mudst, med dk gy to dk gy, wth med gy to med dk gy, typically equal amounta clay, silt and lime, trace pyrite, vague lam, blocky, does not always split parallel to bd, thn to med bd. There are gradations to calc siltst, calc mudst, and arg lst.	
		2300		2175-2235 Dol mudst, med dk gy to dk gy, wth med lt gy, slty, vague lam in pt, thn bd.	2240-70' (Talus) Climacograptus sp., ?Orthograptus vesiculosus penna. (?ZONE OF DIPLOGRAPTUS MODESTUS)
Silurian	mudstone unit			2235-2282 Dol siltst, med dk gy, wth lt ol gy to med gy, sli arg, grap, brittle, fiss, recess, poor exp, thn bd.	2270-85' (Talus) Climacograptus of. scalaris normalis, ?Glyptograptus sp.
				2282-2310 Arg siltst, dk gy, wth med ol gy, equal silt and clay content, dol, scatt sh lithoclasts, grap, lam, penecontemporaneous slumping seen in some bds, reworked in pt, resist, thn to med bd.	2315-40' (Talus) Climacograptus ex gr. scalaris.
		2400		2310-2338 Siltst and slty sh, med dk gy, wth med lt gy to med ol gy, some rust stain, variable dol content, sulphur bloom in pt, scatt pyritic nod, grap, lam in pt, blocky, extensive scree cover.	2340-2400' (Talus) Climacograptus sp., Diplograptus aff. modestus, Glyptograptus of. tamariscus. (?ZONE OF DIPLOGRAPTUS MODESTUS)
				2338-2485 Siltst and slty sh, med dk gy, wth med lt gy to med ol gy, some rust stain, variable dol content, sulphur bloom in pt, scatt pyritic nod, grap, lam in pt, blocky, extensive scree cover.	2400-50' (Talus) Climacograptus sp., ?Orthograptus vesiculosus penna. (?ZONE OF DIPLOGRAPTUS MODESTUS)
		2500		2485-2650 Qtzt, med lt gy to med gy, wth lt gy to br gy, vf gr, some crs silt, sli arg in pt, sli dol in pt, med dk gy to thn bd.	



South Slade Creek Supplementary Section (56° 47' 25"N, 123° 41' 25"W to  
56° 47' 15"N, 123° 41' 55"W)

Section in Silurian siltstone unit measured by author and W. Marsh in 1965, from top downwards.

Footage

0-50	Sh, sltst, minor ss, med dk gy to ol gy, weath br, dol, lam, brittle, fiss, thin bd.
50-150	Covered
150-310	Sltst as in 0-50'.
310-95	Covered. Non-silty sh in talus.
395-445	As 0-50'. <u>Monograptus</u> sp. indet. at 405', Worm burrows.
445-62	Covered.
462-80	Sltst, med dk gy, weath lt br gy, sli resistant, thin bd.
480-525	Covered
525-54	Intbd qtzt (60%), sltst (30%), sh (10%), qtzt becomes more important upwards. Qtzt, med gy to dk bl gy, wealth lt ol gy, vf to f gr, overgrowths, silty, sli calc or dol, faint lam, vague interstratal structures, bd thin to 4'. Pockets of dol at top of interval contain ? <u>Columnaria</u> sp., <u>Fletcheria</u> sp., <u>Craterophyllum</u> aff. <u>invaginatium</u> (Davis), sponge, gastropod, echinoderm columnals.
554-670	Covered.
670	Top of Silurian dolomite unit.

Figure 9

SECTION: SOUTH LADY LAURIER LAKE  
COMPOSITE

LOCATION: Measured in two parts south of Lady Laurier Lake.

- Part 1 (0-1110'): 56° 40' 00"N, 123° 42' 45"W to  
56° 40' 00"N, 123° 43' 15"W.  
Part 2 (850-2900'): 56° 41' 20"N, 123° 45' 00"W to  
56° 40' 50"N, 123° 46' 00"W.

MEASURED BY: Author and W. Marsh in 1965.

MICROLOGGED BY: Author in 1965.

STRATIGRAPHIC SUMMARY:

Cloudmaker Formation:  
quartzite member.....310'  
lower shale and siltstone member.....800'  
Ordovician dolomite unit (incomplete).....1546'

Strata above quartzite member of Cloudmaker Formation are poorly exposed. Section discontinued in Ordovician dolomite unit due to faulting in this unit and the underlying Mount April Formation.

REMARKS: Part 1 and Part 2 correlated at contact of Ordovician dolomite unit with overlying lower shale and siltstone member of the Cloudmaker Formation.  
A thrust fault is present at 2656' and section below this footage is repetitive.  
The entire section is overturned.

Figure 10

SECTION: ADVANCE MOUNTAIN

LOCATION: 56° 03' 00"N, 123° 28' 00"W to  
56° 02' 50"N, 123° 25' 00"W  
Measured along the crest of Advance Mountain.

MEASURED BY: Hudson's Bay Oil and Gas Co. Ltd. in 1960.

MICROLOGGED BY: Author in 1965.

STRATIGRAPHIC SUMMARY:

Devonian light coloured dolomite unit (incomplete)	735'
Siluro-Ordovician dolomite unit -----	1580'
Ordovician sandstone unit -----	110'
Ordovician argillaceous carbonate unit -----	285'
Ordovician dolomite unit (incomplete) -----	235'

REMARKS: Fossils identified by Dr. J. Usher

Age	Rock unit	Footage	Litholog	Lithological descriptions	Fossils and Age
Ordovician	quartzite member	100		0-286 Qtzt with minor eh intbds. Qtzt, v lt gy, wth same to yel gy, vf-f gr, sli dol in pt, intergran leach, resist, thk-mase bd. Sh, dk gy, wth med lt gy, sli slty in pt, recess, mostly cov.	
	lower shale and siltstone member of Cloudmaker Formation	200			
		300		286-290 Sh, dk gy, wth med gy, sli slty in pt, sulphur bloom in pt, grap, v fiss, recess. 290-310 Qtzt with minor sh intbds as 0-286'. 310-337 Sh, med dk gy to dk gy, wth same to br gy, fiss, recess, v poor exp.	282-85' <u>Climacograptus caudatus</u> Lapworth, <u>O. cf. spiniferus</u> Ruedemann, <u>O. sp.</u> , <u>Oicellograptus</u> sp., <u>Dicranograptus kirkii</u> Ruedemann, dicranograptid, <u>Leptograptus</u> sp., <u>Orthograptus quadrimucronatus</u> (J. Hall), <u>O. quadrimucronatus spinigerus</u> (Lapworth), <u>O. ex gr. quadrimucronatus</u> , <u>O. truncatus</u> cf. <u>intermedius</u> aff. <u>Oxlosia</u> . (ZONE OF <u>ORTHOGRAPTUS QUADRIMUCRONATUS</u> )
		400		337-385 Ss, med lt gy, wth rust and maroon, up to 25% microxine dol, vf-f gr, overgrowths, reworked, lam, fairly resist, thn-med bd. 385-432 Sh with few sltst intbds. Sh, med dk gy, wth rust, sli slty, soft, cleaved, poor exp. Sltst, med gy, wth rust, ripple lam delineated by sh skins, resistant.	
		500		432-470 Sh with few qtzt intbds. Sh, med dk gy, shiny, wth rust, slty in pt, soft, poor exp. Qtzt, v lt gy, wth same to yel gy, vf-f gr, scatt sh lithoclasts, resistant.	
		600		470-560 Sh, med dk gy, shiny, wth rust, soft, cleaved, poor exp. 560-565 Qtzt, v lt gy, wth same to yel gy, vf-f gr, resist, thk bd.	590-620' ? <u>Climacograptus</u> sp., <u>Dicranograptus</u> sp.
		700		565-570 Sh, dk gy, wth same to rust, slty in pt, cleaved, recess, poor exp. 570-585 Qtzt as 560-565' but mass bd. 585-588 Ss, bl gy, wth rust, vf-f gr, subang-subrd, overgrowths, poor sort, sli dol in pt, scatt eh skins, resistant, two bds 1' and 1½' thk separated by 6" of fiss sh.	
		800		588-619 Sh, dk gy, wth same to ol gy, slty in pt, grap. One 2' bd of ss, med gy, wth lt ol gy, vf-f gr, subang-subrd, gr show pressure soln, poor sort, 10% dol in pt, scatt sh lithoclasts, X lam at base, hard.	800' dicranograptid. (Talus)
		900		619-640 Ss, or gy, wth rust, vf-f gr, subang-subrd, gr show press soln, poor sort, 10% slt, 10% sh skins, 10% dol in pt, ripple lam, undersurface structures which may be groove casts have N-S orientation, resistant, med bd.	860' (Talus) <u>Dicranograptus nicholsoni</u> Hopkinson.
		1000		640-1110 Sh with sltst becoming more important downwards, interval recess. Sh, dk gy to dk bl gy, wth same to ol gy and rust, slty in pt, sli calc or dol in pt, grap, fiss where not cleaved. Siltst, med dk gy, wth lt ol gy to rust, some lam of v lt gy dol sltst brittle, bd up to 3". At c850' there is a med bd of ss, med gy, wth mod yel br, f-m gr, subrd, mod sort, dol, sli calc, hard	950' (Talus) <u>Climacograptus</u> sp. 990' (Talus) <u>Glyptograptus</u> sp. 1010' (Talus) <u>Climacograptus</u> cf. <u>bicornis</u> (J. Hall), <u>Dicranograptus nicholsoni</u> Hopkinson. (ZONE OF <u>CLIMACOGAPTUS BICORNIS</u> ) 1040' (Talus) <u>Dicranograptus</u> cf. <u>remosis</u> <u>longicaulis</u> Elles & Wood, <u>Glyptograptus</u> sp. (ZONE OF <u>CLIMACOGAPTUS BICORNIS</u> )
		1100		1110-1207 Dol, med lt gy, wth same to med gy, microxine, up to 20% dol org material, small algal balls, gast, heavily veined, resistant, v thk bd.	
		1200		1207-1305 Ool, glistening med dk gy, wth med gy to ol gy, microxine-efxine, 10% dol org material, 10% clay, resist, lumpy splitt planes 4"-1' apart, mass bd.	
		1300		1305-1404 Dol, glistening med gy, wth med lt gy to lt ol gy, microxine-efxine, 5% dol organic material, 5% vf sd, 10% silt, resist, v lumpy splitt planes 4"-5" apart, mass bd.	
		1400		1404-1502 Dol, glistening med dk gy, wth med gy, microxine-efxine, 5% dol org material, 5% slt, much veining, resist, v lumpy splitt planes 4"-5" apart, mass bd.	
		1500		1502-1550 Dol, med lt gy, wth med gy to lt ol gy, becomes lighter wth strat downwards, microxine, 10% dol org material, 5% slt, gast, corals, resist, v lumpy splitt planes 4"-5" apart, mass bd.	1502-50' solitary <u>Climacograptus</u> , <u>macluritid</u> gastropod. (MIDDLE ORDOVICIAN)
		1600		1550-1586 Dol, med dk gy with bl tinge, wth lt ol gy, microxine, 15% clay, sli reworked, recess, lumpy splitt planes 1"-1' apart, bd appears to be mass. 1586-1725 Dol, med gy, wth lt ol gy, microxine, 5% dol org material, 10% vf sd, 5% slt, gast, reworked, relatively recess, lumpy splitt planes 1"-2" apart, mass bd.	1586-1725' <u>Maclurites</u> sp.
		1700		1725-1970 Dol, med dk gy, wth lt ol gy, cryptoxine-microxine, 15% clay, foss, reworked, relatively recess, lumpy splitt planes 1"-2" apart, mass bd.	1725-1970' <u>macluritid</u> gastropod
		1800			
		1900			
		2000		1970-2022 Dol mudst, dk gy, wth med gy, 50-60% clay, rest cryptoxine dol, reworked, recess, splitt planes up to 2" apart, bd appears to be mass. 2022-2111 Dol, glistening med dk gy, wth med gy to med lt gy, microxine-efxine, 5% slt, 0-20% clay, arg dol tends to be reworked, few thin nodular layers of chert, gast, resist, cliff-forming, lumpy splitt planes up to 4" apart, mass bd.	2022-2111' <u>Maclurites</u> sp. (PROBABLY CHAZYAN)
		2100		2111-2376 Dol, med gy to med dk gy, wth med lt gy, microxine-efxine, 0-5% slt, lam in pt, gast, resist, med bd.	
		2200			
		2300			
		2400		2376-2448 Dol, lt gy, wth same, microxine-efxine, 0-5% slt, thin lam in pt, sli recess, thk bd.	
		2500		2448-2526 Ool, med gy, wth yel gy, microxine, 20% clay, lam of varying clay content in pt, reworked, blocky, fairly resist, med bd, av 1".	
		2600		2526-2544 Intbd dol and arg dol in ratio 3:1. Ool, med lt gy, wth lt ol gy, lt gy or or gy, microxine-efxine, up to 25% dol pellets (pellets are rd, sli elongate, up to 3.5mm diam, and give wth surface a distinct spotted appearance), 5% clay. Arg dol, med gy, wth same, microxine, sli calc, 20% clay, reworked. Interval recess, med bd.	
		2700		2544-2592 Arg dol, med lt gy, wth or gy, efxine-vfxine, 25% pellets (pellets rd and up to vc), some sparry dol, 35-40% clay, splitt planes 2" apart, mass bd. 2592-2656 Arg dol as 2544-2592' with shaly intbds, recess, mostly cov. Distinctive varicoloured lithologies make up small part of scree: Sh, yel gy, wth lt gn gy, dol, soft, greasy, fiss. Ool, lt gy, wth lt ol gy to pale red-purple, efxine-vfxine, up to 5% vf sd with overgrowths.	
		2800		2656-2900 Dol, med dk gy, wth med lt gy, wth col becomes sli darker strat downwards, microxine-efxine, 10% dol org material, gast, reworked, lumpy splitt planes, bd appears to be mass.	
		2900			

Age	Rock unit	Footage	Litholog	Lithological descriptions	Fossils and Age
Ordovician	quartzite member	100		0-286 Qtzt with minor sh intbds. Qtzt, v lt gy, wth same to yel gy, vf-f gr, sli dol in pt, intergran leach, resist, thk-mass bd. Sh, dk gy, wth med lt gy, sli slty in pt, recess, mostly cov.	
	lower shale and siltstone member of Cloudmaker Formation	200			
		300		286-290 Sh, dk gy, wth med gy, sli slty in pt, sulphur bloom in pt, grap, v fliss, recess. 290-310 Qtzt with minor sh intbds as 0-286'. 310-337 Sh, med dk gy to dk gy, wth same to br gy, fliss, recess, v poor exp.	282-85' <u>Climacograptus caudatus</u> Lapworth, C. cf. <u>spiniferus</u> Ruademann, Q. ap., <u>Oicellograptus</u> sp., <u>Oicranograptus kirkii</u> Ruemann, dicranograptid, <u>Leptograptus</u> sp., <u>Orthograptus quadrimucronatus</u> (J. Hall), O. <u>quadrimucronatus spinigerus</u> (Lapworth), Q. ax gr. <u>quadrimucronatus</u> , O. <u>truncatus</u> cf. <u>intermedius</u> aff. <u>Oxlosia</u> . (ZONE OF <u>ORTHOGRAPTUS QUADRIMUCRONATUS</u> )
		400		337-385 Ss, med lt gy, wth rust and maroon, up to 25% microxine dol, vf-f gr, overgrowths, reworked, lam, fairly resist, thn-med bd.	
		500		385-432 Sh with few sltst intbds. Sh, med dk gy, wth rust, sli slty, soft, cleaved, poor exp. Sltst, med gy, wth rust, ripple lam delineated by sh skins, resistant.	
		600		432-470 Sh with few qtzt intbds. Sh, med dk gy, shiny, wth rust, slty in pt, soft, poor exp. Qtzt, v lt gy, wth same to yel gy, vf-f gr, scatt sh lithoclasts, resistant.	590-620' ? <u>Climacograptus</u> sp., <u>Dicranograptus</u> sp.
		700		470-560 Sh, med dk gy, shiny, wth rust, soft, cleaved, poor exp.	
		800		560-565 Qtzt, v lt gy, wth same to yel gy, vf-f gr, resist, thk bd.	
		900		565-570 Sh, dk gy, wth same to rust, slty in pt, cleaved, recess, poor exp.	
		1000		570-585 Qtzt as 560-565' but mass bd.	
		1100		585-588 Ss, bl gy, wth rust, vf-f gr, subang-subrd, overgrowths, poor sort, sli dol in pt, scatt sh skins, resistant, two bds 1' and 1½' thk separated by 6" of fliss sh.	800' dicranograptid. (Talus)
Dolomite unit		1200		588-619 Sh, dk gy, wth same to ol gy, slty in pt, grap. One 2' bd of ss, med gy, wth lt ol gy, vf-f gr, subang-subrd, gr show pressure soln, poor sort, 10% dol in pt, scatt sh lithoclasts, X lam at base, hard.	860' (Talus) <u>Dicranograptus nicholsoni</u> Hopkinson.
		1300		619-640 Ss, or gy, wth rust, vf-f gr, subang-subrd, gr show press soln, poor sort, 10% slt, 10% sh skins, 10% dol in pt, ripple lam, undersurface structures which may be grooves casts have N-S orientation, resistant, med bd.	950' (Talus) <u>Climacograptus</u> sp.
		1400		640-1110 Sh with sltst becoming more important downwards, interval recess. Sh, dk gy to dk bl gy, wth same to ol gy and rust, slty in pt, sli calc or dol in pt, grap, fliss where not cleaved. Siltst, med dk gy, wth lt ol gy to rust, some lam of v lt gy dol sltst brittle, bd up to 3". At c850' there is a med bd of ss, med gy, wth mod yel br, f-m gr, subrd, mod sort, dol, sli calc, hard	990' (Talus) <u>Glyptograptus</u> sp.
		1500		1110-1207 Dol, med lt gy, wth same to med gy, microxine, up to 20% dol org material, small algal balls, gast, heavily veined, resistant, v thk bd.	1010' (Talus) <u>Climacograptus</u> cf. <u>bicornis</u> (J. Hall), <u>Oicranograptus nicholsoni</u> Hopkinson. (ZONE OF <u>CLIMACOGRAPTUS BICORNIS</u> )
		1600		1207-1305 Ool, glistening med dk gy, wth med gy to ol gy, microxine-efxine, 10% dol org material, 10% clay, resist, lumpy splitt planes 4"-1' apart, mass bd.	1040' (Talus) <u>Oicranograptus</u> cf. <u>ramosus longicaulis</u> Elles & Wood, <u>Glyptograptus</u> sp. (ZONE OF <u>CLIMACOGRAPTUS BICORNIS</u> )
		1700		1305-1404 Ool, glistening med gy, wth med lt gy to lt ol gy, microxine-efxine, 5% dol organic material, 5% vf sd, 10% silt, resist, v lumpy splitt planes 4"-5" apart, mass bd.	1502-50' solitary coral, macluritid gastropod. (MIOOLE ORDOVICIAN)
		1800		1404-1502 Ool, glistening med dk gy, wth med gy, microxine-efxine, 5% dol org material, 5% slt, much veining, resist, v lumpy splitt planes 4"-5" apart, mass bd.	1586-1725' <u>Maclurites</u> sp.
		1900		1502-1550 Ool, med lt gy, wth med gy to lt ol gy, becomes lighter wth strat downwards, microxine, 10% dol org material, 5% slt, gast, corals, resist, v lumpy splitt planes 4"-5" apart, mass bd.	
		2000		1550-1586 Ool, med dk gy with bl tinge, wth lt ol gy, microxine, 15% clay, sli reworked, recess, lumpy splitt planes 1"-1' apart, bd appears to be mass.	
		2100		1586-1725 Ool, med gy, wth lt ol gy, microxine, 5% dol org material, 10% vf sd, 5% slt, gast, reworked, relatively recess, lumpy splitt planes 1"-2" apart, mass bd.	
		2200		1725-1970 Ool, med dk gy, wth lt ol gy, cryptoxine-microxine, 15% clay, foss, reworked, relatively recess, lumpy splitt planes 1"-2" apart, mass bd.	1725-1970' macluritid gastropod
		2300		1970-2022 Dol mudst, dk gy, wth med gy, 50-60% clay, rest cryptoxine dol, reworked, recess, splitt planes up to 2" apart, bd appears to be mass.	
				2022-2111 Dol, glistening med dk gy, wth med gy to med lt gy, microxine-efxine, 5% slt, 0-20% clay, arg dol tends to be reworked, few thin nodular layers of chert, gast, resist, chert-forming, lumpy splitt planes up to 4" apart, mass bd.	2022-2111' <u>Maclurites</u> sp. (PROBABLY CHAZYAN)
				2111-2376 Ool, med gy to med dk gy, wth med lt gy, microxine-efxine, 0-5% slt, lam in pt, gast, resist, med bd.	

**Silurian unit**

400  
500  
600  
700  
800  
900  
1000  
1100  
1200  
1300  
1400  
1500  
1600  
1700  
1800  
1900  
2000  
2100  
2200  
2300  
2400  
2500  
2600  
2700  
2800  
2900

**Ordovician unit**

**argillaceous carbonate unit**

**ss. unit**

**dolomite unit**

635-735 Ss, wh to med lt gy, wth br gy, m-c gr, rnd, frequently quartzitic, dol in pt - especially near base of interval, thk bd.

735-775 Dol ss, lt gy, wth med gy, f-c gr, rnd, poor sort, few crinoid stems, thk bd. Grades to sdy dol in pt.

775-880 Dol, lt gy to med lt gy, wth med lt gy, efxine-fxine, trace f-m rnd qtz gr in upper pt of interval, thk bd.

880-930 Cov.

930-955 Dol, med lt gy, wth dk gy, efxine-vfxine, chert nods, crinoids, corals, stromatoporoids, thk bd.

955-980 Dol, med dk gy, wth dk gy, efxine-vfxine, up to 5% clay, several 1" chert lenses and nods, corals, bd 2"-6".

980-1040 Cov.

1040-1080 Dol, dk gy, wth same, efxine-vfxine, up to 5% clay extensively chertified, blk chert nods and stringers, corals, brachiopods, thk bd.

1080-1125 Cov.

1125-1145 Dol, med dk gy, wth med gy, vfxine-fxine, mostly thk bd. Interval contains 2 bds (1' thk and 2' thk) of ss, wh to v lt gy, wth same, f gr, scatt m gr, cement siliceous with trace dol, hard.

1145-1200 Dol and ss. Grade into each other in pt. Dol, lt gy to med lt gy, wth med gy, vfxine-fxine, variable content of f-m rnd qtz gr, up to 15% silt, trace clay, thk bd. Ss, wh to v lt gy, wth same, f-c gr, rnd, poor sort, siliceous cement, thk bd mostly but bottom 10' of interval is thn bd.

1200-1235 Dol, med dk gy, wth med gy, efxine-vfxine, 5% silt, scatt sand gr, few wh chert lenses, med bd.

1235-1255 Cov.

1255-1335 Dol, med gy to med dk gy, wth med gy, efxine-vfxine, up to 15% silt, scatt sand gr in top pt of interval, abundant blk chert nods, corals, thn-med bd.

1335-1385 Cov.

1385-1405 Dol, med dk gy, wth med gy, vfxine-fxine, 10% silt, corals, mostly thk bd but thn bd in pt.

1405-1420 Sdy siltst, v lt gy to yel gy, wth same, 60% c silt, 40% vf sand, siliceous cement, X strat in pt, thn-med bd.

1420-1425 Cov.

1425-1435 Sily dol, mottled med lt gy and med gy, wth same to lt gy, efxine-vfxine, up to 40% c silt, trace vf sand, hard, thk bd.

1435-1480 Cov.

1480-1525 Sily dol as 1425-1435'.

1525-1615 Dol, med dk gy, wth same, efxine-vfxine, 5% clay, blk chert nods and stringers, abundant corals and algae in colonies 4' wide and 2' thk, splitting planes 1"-6" apart, bd indistinct.

1615-1720 Dol, med gy, med lt gy and med dk gy in pt, wth med gy, vfxine-fxine, up to 15% silt, trace clay, thk bd.

1720-1775 Dol siltst, med gy, mottled, wth med lt gy to med gy, silt is c, trace clay, grades in pt into sily dol, lam, thk bd.

1775-1870 Dol, med gy, wth br gy, efxine, variable content of vf sand and some bds of dol ss, variable content of c silt, lam reflect varying composition, abundant blk chert lenses, nods and stringers, few corals, thk bd.

1870-1950 Dol, med gy, wth same, efxine-vfxine, trace rusty specks in small pt, splitting planes 1"-8" apart, thk bd.

1950-2040 Dol, med gy, wth dk gy, efxine-fxine, trace clay near base of interval, splitting planes 1"-8" apart, thk bd.

2040-2200 Arg dol, med dk gy to dk gy, wth med gy, efxine-vfxine, 15-20% br clay, extremely abundant blk chert lenses, nods and stringers, pyritic, corals, splitting planes 1"-6" apart.

2200-2240 Dol, med dk gy to dk gy, wth med gy, efxine-vfxine, extremely abundant blk chert lenses, nods and stringers, pyritic, corals, gastropods, cephalopods, pelecypods, brachiopods, crinoids, splitting planes 1"-6" apart.

2240-2280 Dol, lt gy to med gy, wth lt gy, efxine-fxine, splitting planes 8" apart, med bd.

2280-2300 Dol, med dk gy, wth same, vfxine, scatt f rnd sand gr, trace clay, blk chert nods and stringers, crinoids, splitting planes 1"-3" apart.

2300-2335 Cov.

2335-2375 Ss, yel gy to lt ol gy, wth lt gy, vf-f gr, subrnd some gr pitted, some overgrowths, med sorting, sli dol in pt, splitting planes irregular, mass bd.

2375-2400 Qtzt, wh to yel gy, wth lt ol gy, vf-f gr, v thk-mass bd.

2400-2425 Ss, wh to yel gy, wth br, vf-f gr, subrnd-rnd, gr pitted, some overgrowths, sli dol, some leaching, thk bd.

2425-2450 Dol, med dk gy to dk gy, wth med gy to br gy, efxine-vfxine, up to 10% vf-f sand, up to 15% clay splitting planes 1"-4" apart.

2450-2470 Cov.

2470-2535 Dol, med gy to med dk gy, wth br gy, efxine-fxine, up to 40% vf well sort subang-subrnd sand at top of interval, up to 40% clay, sh skins, sli ferruginous, blk chert nods, abundant fossils - brachiopods, bryozoans, crinoids, splitting planes irregular.

2535-2555 Cov.

2555-2660 Lst, med dk gy to dk gy, wth lt gy to dk gy, efxine-vfxine, up to 40% br clay, abundant chert nods and stringers in top 20' of interval, corals, brachiopods, bryozoans, crinoids, splitting planes irregular.

2660-2670 Cov.

2670-2695 Lst, med dk gy to dk gy, wth med gy, efxine-vfxine much crinoidal debris - stems infilled with spar, sli sily in pt, trace clay, splitting planes 1"-3" apart.

2695-2720 Cov.</

Age	Rock unit	Footage	Litholog	Lithological descriptions	Fossils and Age
Devonian	dolomite unit			0-260 Dol, lt gy to med lt gy and yel gy, wth same, efxine-fxine, occ microxine and medxine, ferruginous pellets between 90-105', thk bd.	
		100			
		200			
		300		260-345 Cov.	
		400		345-635 Dol with minor dol ss. Ool, lt gy and yel gy darkening to med gy near base of interval, wth same, efxine-vfxine, occ fxine and medxine, variable content of vf-c rnd qtz gr, sli cherty in pt, med-thk bd. Ool ss, lt gy, wth same to br gy, vf-m, rnd, med -thk bd.	
		500			
		600			
		700		635-735 Ss, wh to med lt gy, wth br gy, m-c gr, rnd, frequently qtzitic, dol in pt - especially near base of interval, thk bd.	
		800		735-775 Dol ss, lt gy, wth med gy, f-c gr, rnd, poor sort, few crinoid stems, thk bd. Grades to sdy dol in pt. 775-880 Dol, lt gy to med lt gy, wth med lt gy, efxine-fxine, trace f-m rnd qtz gr in upper pt of interval, thk bd.	
		900		880-930 Cov.	
Silurian	dolomite unit			930-955 Ool, med lt gy, wth dk gy, efxine-vfxine, chert nods, crinoids, corals, stromatoporoids, thk bd. 955-980 Dol, med dk gy, wth dk gy, efxine-vfxine, up to 5% clay, several 1" chert lenses and nods, corals, bd 2"-6". 980-1040 Cov.	930' <i>Chonophyllum</i> sp., <i>Ocinophyllum</i> sp., <i>Favosites</i> spp., stromatoporeid, <i>Cyrtina</i> sp. (SILURIAN)
		1000		1040-1080 Ool, dk gy, wth same, efxine-vfxine, up to 5% clay extensively chertified, blk chert nods and stringers, corals, brachiopods, thk bd.	950-55' <i>Favosites</i> sp., <i>Catenipora</i> aff. <i>gracilis</i> (Hall), <i>Heliolites</i> sp. (SILURIAN)
		1100		1080-1125 Cov.	
		1200		1125-1145 Ool, med dk gy, wth med gy, vfxine-fxine, mostly thk bd. Interval contains 2 bds (1' thk and 2' thk) of ss, wh to v lt gy, wth same, f gr, scatt m gr, cement siliceous with trace dol, hard.	
		1300		1145-1200 Dol and ss. Grade into each other in pt. Ool, lt gy to med lt gy, wth med gy, vfxine-fxine, variable content of f-m rnd qtz gr, up to 15% silt, trace clay, thk bd. Ss, wh to v lt gy, wth same, f-c gr, rnd, poor sort, siliceous cement, thk bd mostly but bottom 10' of interval is thn bd.	
		1400		1200-1235 Dol, med dk gy, wth med gy, efxine-vfxine, 5% silt, scatt sand gr, few wh chert lenses, med bd. 1235-1255 Cov. 1255-1335 Dol, med gy to med dk gy, wth med gy, efxine-vfxine, up to 15% silt, scatt sand gr in top pt of interval, abundant blk chert nods, corals, thn-med bd.	1305' <i>Favosites</i> sp., <i>Halysites</i> cf. <i>catenularia</i> (Linnaeus), <i>?Streptelasma</i> sp. (PROBABLY SILURIAN)
		1500		1335-1385 Cov. 1385-1405 Ool, med dk gy, wth med gy, vfxine-fxine, 10% silt, corals, mostly thk bd but thn bd in pt.	1385' <i>Favosites</i> sp.
		1600		1405-1420 Sdy sltst, v lt gy to yel gy, wth same, 60% c silt, 40% vf sand, siliceous cement, X strat in pt, thn-med bd.	
		1700		1420-1425 Cov. 1425-1435 Slty dol, mottled med lt gy and med gy, wth same to lt gy, efxine-vfxine, up to 40% c silt, trace vf sand, hard, thk bd.	1530-1615' <i>Favosites</i> sp., <i>Halysites</i> sp., solitary corals, <i>?Syringopora</i> sp. (PROBABLY SILURIAN)
				1435-1480 Cov. 1480-1525 Slty dol as 1425-1435'. 1525-1615 Dol, med dk gy, wth same, efxine-vfxine, 5% clay, blk chert nods and stringers, abundant corals and algae in colonies 4' wide and 2' thk, splitting planes 1"-6" apart, bd indistinct.	
				1615-1720 Ool, med gy, med lt gy and med dk gy in pt, wth med gy, vfxine-fxine, up to 15% silt, trace clay, thk bd.	
				1720-1775 Dol sltst, med gy, mottled, wth med lt gy to med gy, silt is c, trace clay, grades in pt into slty dol. Lem. thk bd.	

Figure 11

SECTION: WEDGE PEAK

LOCATION: 56° 03' 25"N, 123° 32' 00"W to  
56° 02' 15"N, 123° 32' 00"W.  
Measured on south face of Wedge Peak.

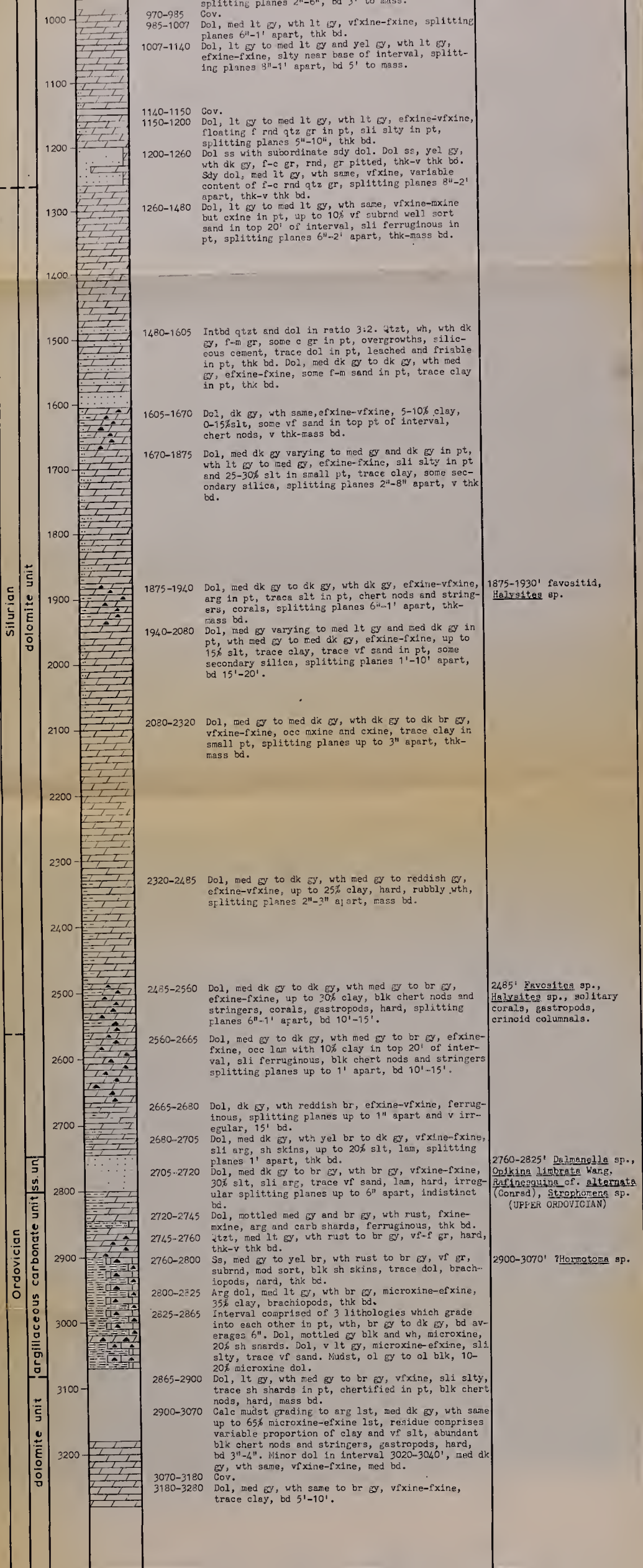
MEASURED BY: Hudson's Bay Oil and Gas Co. Ltd. in 1960.

MICROLOGGED BY: Author in 1965.

STRATIGRAPHIC SUMMARY:

Devonian light coloured dolomite unit (incomplete)	1260'
Siluro-Ordovician dolomite unit -----	1485'
Ordovician sandstone unit -----	55'
Ordovician argillaceous carbonate unit -----	280'
Ordovician dolomite unit (incomplete) -----	200'

REMARKS: Fossils identified by Dr. J. Usher.



Age	Rock unit	Footage	Litholog	Lithological descriptions	Fossils and Age
Devonian	dolomite unit	100		0-145 Dol with subordinate ss. Dol, lt gy to med lt gy and yel gy, wth lt gy, ef-xine-vfxine, variable content of f-c rnd qtz gr, sli ferruginous, vague banding in pt, splitting planes up to 2" apart, mass bd. Ss, wh to lt gy and yel gy, wth lt br gy, f-m, ooc to c gr, rnd, gr often pitted, overgrowths, cement siliceous or dol, hard, bd 1'-2'.	
		200		145-160 Cov. 160-245 Dol with subordinate ss as 0-145'.	
		300		245-315 Cov.	
		400		315-520 Dol with subordinate ss as 0-145'.	
		500			
		600		520-780 Dol, lt gy to med lt gy, ooc lt ol gy, yel gy, med gy or med dk gy, wth lt gy, ef-xine-fxine, ooc microxine and mxine, sli slty in pt, splitting planes 2"-1', thk-mass bd.	
		700			
		800		780-950 Dol, lt gy to med lt gy, some red stain, wth lt gy, mxine-oxine, ooc vxine, splitting planes 4"-1', bd 3'-5'.	
		900			
		1000		950-970 Dol, lt gy to med lt gy, wth lt gy, ef-xine-vfxine, splitting planes 2"-6", bd 3' to mass. 970-985 Cov. 985-1007 Dol, med lt gy, wth lt gy, vfxine-fxine, splitting planes 6"-1' apart, thk bd.	
Silurian	dolomite unit	1100		1007-1140 Dol, lt gy to med lt gy and yel gy, wth lt gy, ef-xine-fxine, slty near base of interval, splitting planes 3"-1' apart, bd 5' to mass.	
		1200		1140-1150 Cov. 1150-1200 Dol, lt gy to med lt gy, wth lt gy, ef-xine-vfxine, floating f rnd qtz gr in pt, sli slty in pt, splitting planes 5"-10", thk bd.	
		1300		1200-1260 Dol ss with subordinate sdgy dol. Dol ss, yel gy, wth dk gy, f-c gr, rnd, gr pitted, thk-v thk bd. Sdgy dol, med lt gy, wth same, vfxine, variable content of f-c rnd qtz gr, splitting planes 8"-2' apart, thk-v thk bd.	
		1400		1260-1480 Dol, lt gy to med lt gy, wth same, vfxine-mxine but cxine in pt, up to 10% vf subrnd well sort sand in top 20' of interval, sli ferruginous in pt, splitting planes 6"-2' apart, thk-mass bd.	
		1500		1480-1605 Intbd qtz and dol in ratio 3:2. Qtz, wh, wth dk gy, f-m gr, some c gr in pt, overgrowths, siliceous cement, trace dol in pt, leached and friable in pt, thk bd. Dol, med dk gy to dk gy, wth med gy, ef-xine-fxine, some f-m sand in pt, trace clay in pt, thk bd.	
		1600		1605-1670 Dol, dk gy, wth same, ef-xine-vfxine, 5-10% clay, 0-15% slt, some vf sand in top pt of interval, chert nodes, v thk-mass bd.	
		1700		1670-1875 Dol, med dk gy varying to med gy and dk gy in pt, wth lt gy to med gy, ef-xine-fxine, sli slty in pt and 25-30% slt in small pt, trace clay, some secondary silica, splitting planes 2"-8" apart, v thk bd.	
		1800			
		1900		1875-1940 Dol, med dk gy to dk gy, wth dk gy, ef-xine-vfxine, arg in pt, trace slt in pt, chert nodes and stringers, corals, splitting planes 6"-1' apart, thk-mass bd.	1875-1930' favositid, <i>Halysites</i> sp.
		2000		1940-2080 Dol, med gy varying to med lt gy and med dk gy in pt, wth med gy to med dk gy, ef-xine-fxine, up to 15% slt, trace clay, trace vf sand in pt, some secondary silica, splitting planes 1'-10' apart, bd 15'-20'.	
		2100		2080-2320 Dol, med gy to med dk gy, wth dk gy to dk br gy, vfxine-fxine, ooc mxine and cxine, trace clay in small pt, splitting planes up to 3" apart, thk-mass bd.	

CLEARWATER CREEK SECTION (55° 49'N, 123° 15'W).

Measured by Dr. B. S. Norford of the Geological Survey of Canada in 1961. Section measured west of Clearwater Creek, about 6 miles southwest of Ducette Peak. Only summary lithological descriptions are presented here. Section measured from top to bottom.

Footage

Middle Devonian

0-591	Lst and calc sh with Middle Devonian fossils.
591	Top of Devonian dolomite unit.
591-1466	Dol, v lt gy to lt gy, with gy to yel gy, microxine-vfxine, sdy in pt, siliceous, stylolites, bd 1' to mass. No fossils found.
1466-1668	Ss, lt gy, with gy to yel gy, vf-c gr, rnd, 30% dol, resist, bd 3" to 5'.
1668-2104	Dol as 591'-1466'.
2104	Top of Silurian and Ordovician dolomite unit.
2104-2276	Dol, dk gy, with gy, vfxine-cxine, corals and stromatoporoids, bd 1' to mass.
2276-2310	Dol, br gy, with lt gy, vfxine, siliceous, corals, brachs, bd 3" to 2'. Minor qtzite and dol ss.
2310-2556	Dol, dk gy, with gy, vfxine-fxine, sdy in pt, siliceous, rare chert nods, corals, stromatoporoids, brachiopods, resist, bd 1' to mass. <u>Columnaria columbia</u> Norford and <u>Favosites</u> aff. <u>biloculi</u> Hall between 2431' and 2491'. <u>Coenites</u> sp., <u>F.</u> aff. <u>biloculi</u> Hall between 2459' and 2474'. <u>Favosites</u> sp. between 2521' and 2541'.
2556	Top of Ordovician.
2556-2941	Dol, gy, with dull gy, microxine-fxine, siliceous in pt, sdy at base, lam in pt, corals, stromatoporoids, brachs, bd 3" to mass and rubbly. <u>Bighornia</u> sp., <u>Lobocorallium</u> aff. <u>trilobatum</u> (Whiteaves), <u>Rhynchotrema increbescens occidens</u> Wilson between 2840' and 2871'.
2941	Top of Ordovician sandstone unit.
2941-3098	Ss and qtzite, br gy, with lt br, f-c gr, rnd, dol in pt, lam and X-lam in pt, bd 2" to 4'. Siliceous dolomite beds between 3039' and 3041' have <u>Catenipora</u> sp.
3098	Top of Ordovician dolomite unit



3098-3462

Dol, gy, with same, vfxine-fxine, rare chert nod, brachs, gast, echinoderm debris, bd 2" to 2' and some flaggy. Orthambonites cf. marshalli (Wilson) and aff. Orthidiella between 3112' and 3117'.

Section underlain by limestone.



APPENDIX B

FOSSIL IDENTIFICATIONS

Localities are listed from north to south and all sections were measured from top to bottom. Where a section has been measured by different organizations the original footages are given.

The following collection abbreviations are used:

ED.... Fossil collection made by author in 1964 or 1965. Collections stored at Department of Geology, University of Alberta, Edmonton.

GSC.. Fossil collection made by Dr. G.C. Taylor, Geological Survey of Canada in 1964 on Operation Liard. Collections stored at Ottawa.

S .... Fossil collection made by Shell Canada Ltd. in 1960. Collections stored at Edmonton.

Fossils collected by Hudson's Bay Oil and Gas Company Ltd. and Pan American Petroleum Corporation are stored at Calgary.

Fossils examined by Dr. B.S. Norford are denoted by an asterisk (\*).

Authorship of graptolite species is given in Tables 3 and 4.

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NORTH CHESTERFIELD LAKE SECTION. (57° 44'N, 125° 07'W)

Fossils collected by the author in 1964. Section measured down creek flowing southwards into western end of Chesterfield Lake.

<u>Footage</u>	<u>Collection</u>	<u>Fossil Identifications</u>	<u>Age</u>
	Sandpile Group (incomplete)		
50 Talus	ED 6462	<u>Monograptus</u> sp. indet.	Silurian
100	?Top of lower shale and siltstone member of Cloudmaker Formation		
120-28	ED 6465	<u>Glyptograptus</u> sp. undet.	



987-89	ED 6445	<u>Cryptograptus</u> sp. <u>Glyptograptus euglyphus</u> <u>Isograptus forcipiformis</u> dichograptid graptolite undet. caryocarid	<u>etheridgei</u> <u>Zone</u>
1004-58	ED 6447	<u>Tetragraptus</u> sp. (horizontal type)	
1304-20	ED 6467	<u>Amplexograptus confertus</u> <u>Cryptograptus antennarius</u> <u>C.</u> sp. A <u>Dichograptus</u> sp. indet. <u>D.</u> sp. undet. (hexad type) <u>Didymograptus euodus</u> <u>?D. robustus</u> <u>D.</u> sp. indet. <u>Glossograptus</u> sp. indet. <u>Glyptograptus teretiusculus</u> <u>?holmograptid graptolite</u> <u>Isograptus</u> cf. <u>caduceus nanus</u> <u>Paraglossograptus etheridgei</u> <u>?Pseudodichograptus confertus</u> <u>"Strophograptus"</u> <u>Tetragraptus bigsbyi</u> var. <u>latus</u> <u>T.</u> ex gr. <u>bigsbyi</u> <u>T.</u> aff. <u>pendens</u> <u>T.</u> sp. (horizontal type) <u>?Trigonograptus</u> sp. caryocarid inarticulate brachiopod indet.	<u>etheridgei</u> <u>Zone</u>
1392-1408	ED 6468	<u>Dichograptus</u> cf. <u>octobrachiatus</u> <u>D.</u> sp. undet. (slender type) <u>D.</u> sp. indet. <u>Didymograptus</u> aff. <u>extensus</u> <u>D.</u> aff. <u>nitidus</u> <u>D.</u> <u>procumbens</u> <u>D.</u> sp. <u>Isograptus caduceus divergens</u> <u>I.</u> <u>caduceus maximo-divergens</u> <u>I.</u> sp. A <u>I.</u> sp. B <u>I.</u> sp. <u>Phyllograptus</u> aff. <u>angustifolius</u> <u>Tetragraptus</u> sp. indet. caryocarid	<u>caduceus</u> <u>Zone</u>



1445-48 Talus	ED 6470 to ED 6473	<u>Dichograptus</u> cf. <u>marathonensis</u> <u>D. cf. octobrachiatus</u> <u>D. spp. indet.</u> <u>Didymograptus</u> aff. <u>extensus</u> <u>D. aff. nitidus</u> <u>D. sp. undet.</u> <u>Isograptus caduceus divergens</u> <u>I. cf. caduceus divergens</u> <u>I. caduceus maximo-divergens</u> <u>I. sp. A</u> <u>Tetragraptus</u> sp. indet. <u>Trigonograptus ensiformis</u> caryocarid	<u>caduceus</u> Zone
1569-71	ED 6459	dichograptid graptolite indet.	
1580	Top of Mount April Formation		
1700	ED 6451	dichograptid graptolite indet.	
2063-66	ED 649	<u>Conotreta</u> sp. gastropod indet. ellesmerocerid cephalopod indet. annulate cyrtoconic cephalopod ? <u>Trigonocerca</u> sp. trilobite pygidium indet.	probably trilobite Zone H
2294-2346	ED 6417 ED 6418 and ED 6419	<u>Conotreta</u> sp. bellerephontid gastropods indet. <u>Robsonoceras</u> sp. <u>Shumardia</u> sp. ? plimerid trilobite trilobite indet.	possibly trilobite Zone G
3050 Float	ED 6439	<u>Conotreta</u> sp. <u>Matherellina</u> sp. aff. <u>Megalomphala</u> sp. <u>Robsonoceras</u> sp. ? <u>Walcottoceras</u> sp. ? <u>Isoteloides</u> sp. <u>Protopliomerops</u> sp. <u>Shumardia</u> sp. trilobite pygidium indet.	possibly trilobite Zone G
3426-38	ED 6443	bryozoan undet. <u>Elkania</u> sp. aff. <u>Pseudobolus</u> sp. (continued)	probably trilobite Zone D



		<p>? <u>Matherellina</u> sp.  aff. <u>Megalomphala</u> sp.  ? <u>Ophileta</u> sp.  ? <u>Schizopea</u> sp.  <u>Tropidodiscus</u> sp.  bellerephontid gastropod undet.  <u>Robsonoceras</u> sp.  cf. <u>Ventroloboceras</u> sp.  <u>Apatokephalus</u> sp.  ? <u>Geragnostus</u> sp.  <u>Hystericurus</u> sp.  protopliomerid trilobite  <u>Shumardia</u> sp.  trilobite pygidium undet.  trilobite indet.  echinoderm columnals  Problematica, ? echinoderm vascular system process  Problematica, ? echinoderm star-like process</p>	
3456-3510	ED 6453	<p>bryozoan undet.  <u>Elkania</u> sp.  <u>Lytospira</u> sp.  aff. <u>Megalomphala</u> sp.  bellerephontid gastropod undet.  <u>Robsonoceras</u> sp.  ? <u>Apatokephalus</u> sp.  ? <u>Shumardia</u> sp.  trilobite indet.  echinoderm columnals  Problematica, ? echinoderm vascular system process  Problematica, ? echinoderm star-like process</p>	<p>probably  trilobite  Zone D</p>
3545-65	ED 6456 and ED 6457	<p>bryozoan undet.  <u>Conotreta</u> sp.  <u>Elkania</u> sp.  <u>Lingulepis</u> sp.  obolid brachiopod  orthid brachiopod  aff. <u>Megalomphala</u> sp.  <u>Schizopea</u> sp.  <u>Robsonoceras</u> sp.  ? <u>Apatokephalus</u> sp.  <u>Hyperagnostus</u> sp.  ? <u>Hystericurus</u> sp.  ? <u>Micragnostus</u> sp.  <u>Shumardia</u> sp.  trilobite cranidium undet.  echinoderm columnals  Problematica, ? echinoderm star-like process</p>	<p>probably  trilobite  Zone D</p>



SOUTH KWADACHA RIVER SECTION 1. (57° 33'N, 125° 05'W)

Fossils collected by the Geological Survey of Canada in 1964. Section measured along the third ridge directly north of the swamp at the head of Paul River.

<u>Footage</u>	<u>Collection</u>	<u>Fossil Identifications</u>	<u>Age</u>
	Sandpile Group (incomplete)		
185-95	GSC 65988	<u>Cyrtograptus</u> sp. indet. <u>Monograptus</u> ex gr. <u>priodon</u> <u>M.</u> sp. indet.	Wenlockian
210	GSC 66011	? <u>Cyrtograptus</u> sp. <u>Monograptus</u> spp. indet.	probably Wenlockian
1057-59	GSC 65950	<u>Dimorphograptus</u> sp. <u>Diplograptus</u> sp. A. <u>Glyptograptus</u> sp. <u>Monograptus</u> cf. <u>gregarius</u> sponge spicules	<u>cyphus</u> Zone
1065	? Top of lower shale and siltstone member of Cloudmaker Formation		
1070-75 Talus (probably from interval 1057-59)	GSC 65963	<u>Climacograptus</u> sp. <u>Diplograptus</u> sp. A. <u>Monograptus</u> <u>concinnus</u> <u>M.</u> cf. <u>gregarius</u>	<u>cyphus</u> Zone

SOUTH KWADACHA RIVER SECTION 2. (57° 33'N, 125° 04'W)

Fossils collected by the Geological Survey of Canada in 1964. Section measured along the second ridge directly north of the swamp at the head of Paul River.

<u>Footage</u>	<u>Collection</u>	<u>Fossil Identifications</u>	<u>Age</u>
	Sandpile Group (incomplete)		
604	? Top of lower shale and siltstone member of Cloudmaker Formation		
824-44 Talus	GSC 66008	<u>Dicellograptus</u> cf. <u>morrissi</u> <u>D.</u> sp. <u>Orthograptus</u> ex gr. <u>truncatus</u> ? <u>O.</u> sp. <u>Retiograptus</u> cf. <u>pulcherrimus</u> <u>R.</u> sp.	probably <u>intermedius</u> Zone



874-944 Talus	GSC 65938	<u>Climacograptus bicornis</u> <u>C. sp.</u> <u>Dicellograptus cf. elegans</u> <u>D. cf. johnstrupi</u> <u>Orthograptus calcaratus cf. basilicus</u> <u>O. ex gr. calcaratus</u> <u>O. quadrimucronatus inequispinosus</u> <u>O. aff. quadrimucronatus</u> <u>O. truncatus cf. intermedius</u> <u>O. truncatus cf. var. strigosus</u>	<u>intermedius</u> Zone
944	Fault. Palaeontological evidence and lithological correlations with Section 1 indicate that the fault has cut out 465' of section. This amount of missing section is not included in the following footages.		
944 Talus	GSC 65964	<u>Climacograptus sp. indet.</u> <u>?Diplograptus ingens</u> <u>Orthograptus ex gr. truncatus</u>	<u>bicornis or</u> <u>intermedius</u> Zone
2233	GSC 66015	<u>Climacograptus aff. antiquus</u> dichograptid graptolite indet. <u>Glossograptus sp. indet.</u> <u>Glyptograptus cf. euglyphus</u> <u>G. cf. teretiusculus</u> <u>Retiograptus geinitzianus</u>	<u>euglyphus</u> Zone
2271-81	GSC 65983	<u>?Cryptograptus sp.</u> <u>Glossograptus hincksii</u> <u>Glyptograptus cf. euglyphus</u> <u>G. cf. euglyphus major</u>	<u>euglyphus</u> Zone
2341	GSC 66000	<u>Climacograptus riddellensis</u> <u>Cryptograptus sp.</u> dendroid graptolite indet. dichograptid graptolite indet. <u>Glossograptus hincksii</u> <u>Glyptograptus euglyphus</u> <u>G. sp.</u> inarticulate brachiopod indet.	<u>euglyphus</u> Zone

SPOT COLLECTION SOUTHEAST OF HEADWATERS OF PAUL RIVER. (57° 30'N, 124° 57'W)

Fossils collected by the Geological Survey of Canada in 1964. Collection from the Sandpile Group near the summit of the first peak east of the swamp at the head of Paul River.



<u>Collection</u>	<u>Fossil Identifications</u>	<u>Age</u>
GSC 65946	? <u>Cyrtograptus</u> sp. <u>Monograptus</u> cf. <u>sardous</u> lyssakid sponge undet.	Wenlockian

MIXED COLLECTION SOUTH OF HEADWATERS OF PAUL RIVER. (57° 28'N, 124° 59'W)

Fossils collected by the Geological Survey of Canada in 1964. Mixed collection from the Sandpile Group and Cloudmaker Formation on the eastern side of an unnamed peak two miles south of the swamp at the head of Paul River.

<u>Collection</u>	<u>Fossil Identifications</u>	<u>Age</u>
GSC 66017	<u>Climacograptus</u> cf. <u>medius</u> <u>Glyptograptus</u> cf. <u>persculptus</u> <u>Monograptus</u> cf. <u>spiralis</u> ? <u>M. triangulatus</u> <u>M. spp.</u> undet. <u>Retiolites</u> <u>geinitzianus</u> lyssakid sponge undet.	Llandoveryan
	<u>Climacograptus</u> cf. <u>tubuliferus</u> <u>C. sp.</u> undet. <u>Dicellograptus</u> sp. A <u>D. sp.</u> undet. <u>Orthograptus</u> ex. gr. <u>truncatus</u> <u>O. sp.</u> undet. <u>Retiograptus</u> sp.	probably <u>intermedius</u> Zone

NORTH AKIE RIVER SECTIONS.

Pan American Petroleum Corporation measured a section north of Akie River in 1961. This section is located on a peak at 57° 21' 30"N, 124° 34' 30"W - two miles south-east of a small unnamed lake. Graptolite identifications from this section were published by Jackson, Steen, and Sykes in 1965. In this particular area, Ordovician and Silurian rocks are very well exposed and graptolite identifications from three additional sections (all of which are at slightly different locations) are recorded.

a. Fossils collected by the Geological Survey of Canada in 1964 at a location 57° 23' 30"N, 124° 35' 00"W - just east of a small unnamed lake.



Mixed collection from the Sandpile Group and the Cloudmaker Formation. Talus interval 10-30' above the top of the quartzite member of the Cloudmaker Formation.

<u>Collection</u>	<u>Fossil Identifications</u>	<u>Age</u>
GSC 65961	<u>Climacograptus</u> cf. <u>medius</u>	<u>cyphus</u>
	<u>C. ex gr. scalaris</u>	<u>Zone</u>
	<u>C. sp.</u>	
	<u>Dimorphograptus confertus swanstoni</u>	
	<u>Diplograptus</u> sp. A	
	<u>D. sp. undet.</u>	
	<u>Glyptograptus</u> cf. <u>persculpius</u>	
	<u>Monograptus</u> cf. <u>acinaces</u>	
	<u>M. cf. concinnus</u>	
	<u>Orthograptus vesiculosus</u>	
	<u>Dicellograptus</u> cf. <u>complanatus</u>	<u>ornatus</u>
		<u>Zone</u>

Collection from quartzite member of Cloudmaker Formation. Shale bed 270' below the top.

<u>Collection</u>	<u>Fossil Identifications</u>	<u>Age</u>
GSC 65981	<u>Climacograptus</u> cf. <u>spiniferus</u> <u>C.</u> sp. <u>Dicellograptus</u> cf. <u>johnstrupi</u> <u>D.</u> cf. <u>forchammeri flexuosus</u> <u>D.</u> sp. <u>Dicranograptus</u> sp. <u>Leptograptus</u> sp. <u>Orthograptus calcaratus</u> cf. <u>basilicus</u> <u>O.</u> cf. <u>quadrimumcronatus</u> <u>O.</u> <u>quadrimumcronatus spinigerus</u> <u>O.</u> sp. <u>Plegmatograptus</u> sp. aff. <u>Oxlosia</u> sp.	probably <u>quadrimumcronatus</u> Zone

b) Fossils collected by the Geological Survey of Canada in 1964 from a section located at 57° 22' 30"N, 124° 35' 00"W ~ just south of a small unnamed lake.

<u>Footage</u>	<u>Collection</u>	<u>Fossil Identifications</u>	<u>Age</u>
	Sandpile Group (incomplete)		
1036-41 Talus	GSC 65976	<u>Cyrtograptus cf. lapworthi</u> <u>Monograptus priodon</u> <u>M. ex gr. priodon</u> <u>?plectograptid graptolite</u>	probably <u>spiralis</u> Zone



1196	? Top of upper shale and siltstone member of Cloudmaker Formation		
1211-21 Talus	GSC 65956	<u>Climacograptus hastatus</u> <u>Dicellograptus complanatus</u> <u>Diplograptus crassifestus</u> <u>Orthograptus calcaratus</u> var. undet. <u>O. ex gr. calcaratus</u> <u>O. truncatus abbreviatus</u> aff. <u>Oxlosia</u> sp.	<u>ornatus</u> <u>Zone</u>
1281	Top of quartzite member of Cloudmaker Formation		
1521-26	GSC 65985	<u>Climacograptus raricaudatus</u> <u>C. cf. typicalis</u> <u>C. sp. indet.</u> <u>Dicranograptus kirki</u> <u>Leptograptus flaccidus macer</u> <u>Orthograptus ex gr. calcaratus</u> (2 vars.) <u>O. quadrimucronatus</u> <u>O. cf. quadrimucronatus</u> <u>O. quadrimucronatus spinigerus</u> <u>O. truncatus cf. intermedius</u> <u>O. aff. whitfieldi</u> aff. <u>Oxlosia</u> sp.	<u>quadrimucronatus</u> <u>Zone</u>
1566	Top of lower shale and siltstone member of Cloudmaker Formation		
1566-72	GSC 65957	<u>Climacograptus bicornis</u> <u>C. cf. bicornis tridentatus</u> <u>C. cf. typicalis</u> <u>Dicellograptus forchammeri</u> (in relief) <u>D. cf. gurleyi</u> <u>D. cf. johnstrupi</u> <u>Dicranograptus cf. kirki</u> <u>Leptograptus flaccidus</u> <u>Orthograptus cf. quadrimucronatus</u> <u>O. quadrimucronatus cf. spinigerus</u> <u>O. ex gr. quadrimucronatus</u> <u>O. truncatus intermedius</u> <u>Plegmatograptus sp.</u> aff. <u>Oxlosia</u> sp.	<u>intermedius</u> <u>Zone</u>
1866-71 Talus	GSC 65977	<u>Climacograptus sp. indet.</u> <u>Cryptograptus tricornis</u> <u>Dicellograptus sp. indet.</u> <u>Glyptograptus euglyphus</u> <u>Leptograptus sp. undet.</u> ? <u>Nemagraptus gracilis</u> ? manubriate isograptid graptolite	probably <u>gracilis</u> <u>Zone</u>



2023-37	GSC 65975	<u>Climacograptus</u> aff. <u>antiquus</u> <u>C.</u> sp. undet. <u>Cryptograptus</u> sp. A <u>Didymograptus</u> <u>serratulus</u> <u>D.</u> spp. indet. <u>Glossograptus</u> aff. <u>hincksii</u> <u>G.</u> sp. <u>Glyptograptus</u> cf. <u>euglyphus</u> <u>Isograptus</u> aff. <u>ovatus</u> <u>Pterograptus</u> <u>sinicus</u> uniserial graptolite undet. caryocarid	probably <u>etheridgei</u> Zone
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2448-52	GSC 65955	<u>Didymograptus</u> <u>columbianus</u> ? <u>Isograptus</u> sp. <u>Phyllograptus</u> sp. <u>Tetragraptus</u> sp. (horizontal type)	<u>protobifidus</u> Zone
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2480 Top of Mount April Formation

c. Fossils collected by Shell Canada Ltd. in 1960 from a section located at 57° 22'N, 124° 35'W - almost two miles southeast of a small unnamed lake.

<u>Footage</u>	<u>Collection</u>	<u>Fossil Identifications</u>	<u>Age</u>
	Sandpile Group (incomplete)		
650-55	S 15416	<u>Cyrtograptus</u> sp. <u>Monograptus</u> <u>priodon</u> <u>M.</u> ex gr. <u>vomerinus</u> <u>M.</u> sp. indet.	probably Wenlockian
697	S 15417	<u>Climacograptus</u> sp. indet ? <u>Monograptus</u> <u>spiralis</u> <u>M.</u> spp. indet.	possibly <u>spiralis</u> Zone
848-50	S 15418	<u>Climacograptus</u> sp. indet. <u>Monograptus</u> cf. <u>gregarius</u> <u>M.</u> sp. indet	? <u>gregarius</u> Zone
915	? Top of upper shale and siltstone member of Cloudmaker Formation		
1000	Top of quartzite member of Cloudmaker Formation		
1247-51	S 15420	<u>Climacograptus</u> cf. <u>caudatus</u> <u>Dicranograptus</u> sp. <u>D.</u> sp. (continued)	probably <u>quadrimucron-</u> <u>aius</u> Zone



Diplograptus multident compactus  
Orthograptus ex gr. calcaratus  
O. cf. truncatus intermedius  
O. truncatus pauperatus  
O. aff. whitfieldi

1280 Top of lower shale and siltstone member of Cloudmaker Formation

1281-91 S 15421 Climacograptus bicornis probably  
Dicranograptus sp. indet. intermedius  
Leptograptus sp. indet. Zone  
Orthograptus ex gr. calcaratus  
O. cf. quadrimucronatus spinigerus  
O. ex gr. truncatus

1453-63 S 15422 Climacograptus cf. bicornis bicornis  
C. sp. indet. Zone  
Dicranograptus nicholsoni  
Orthograptus calcaratus acutus

1513-23 S 15423 Climacograptus bicornis bicornis  
?Dicellograptus sp. Zone  
Orthograptus calcaratus acutus  
aff. Oxlosia sp.

1533-46 S 15424 Climacograptus bicornis bicornis  
C. cf. raricaudatus Zone  
Orthograptus cf. calcaratus acutus

1817 S 15425 graptolites indet.

2110 ?Top of Mount April Formation

# SOUTH AKIE RIVER SECTION. (57° 17'N, 124° 26'W)

Fossils collected by the Geological Survey of Canada in 1964. Section measured along a northwest trending ridge south of Akie River.

<u>Footage</u>	<u>Collection</u>	<u>Fossil Identifications</u>	<u>Age</u>
	Sandpile Group (incomplete)		
53	GSC 65960	<u>Monograptus cf. dubius</u> <u>M. priodon</u> <u>M. sp. indet.</u> <u>Lyssakid sponge undet.</u>	Wenlockian



60	GSC 65959	<u>Monograptus</u> sp. indet.	
440	? Top of upper shale and siltstone member of Cloudmaker Formation		
525	Top of quartzite member of Cloudmaker Formation		
805	Top of lower shale and siltstone member of Cloudmaker Formation		
874-76.5	GSC 65953	<u>Climacograptus bicornis</u> <u>C. bicornis longispina</u> <u>C. bicornis peltifer</u> <u>Dicellograptus elegans</u> <u>D. sp. undet. (in relief)</u> <u>Dicranograptus nicholsoni</u> <u>Glossograptus</u> sp. <u>Orthograptus calcaratus acutus</u> <u>O. cf. truncatus intermedius</u> <u>O. sp.</u>	<u>bicornis</u> <u>and</u> <u>intermedius</u> <u>Zones</u>
1056	GSC 65948	<u>Climacograptus</u> aff. <u>antiquus</u> <u>Dicellograptus</u> cf. <u>forchammeri</u> <u>D. gurleyi</u> <u>Glyptograptus</u> cf. <u>teretiusculus</u>	<u>probably</u> <u>gracilis</u> <u>Zone</u>
1176-81	GSC 65972	<u>Amplexograptus</u> sp. undet. <u>Climacograptus</u> sp. indet. <u>Glossograptus hincksii</u> <u>G. sp. undet.</u> <u>Glyptograptus</u> cf. <u>euglyphus</u> <u>G. teretiusculus</u> <u>Phyllograptus nobilis</u>	<u>euglyphus</u> <u>Zone</u>
1740	Top of Mount April Formation		

NORTH SIKANNI CHIEF RIVER SECTION. (57° 12' 20"N, 123° 52' 50"W to 57° 12' 15"N, 123° 53' 50"W).

Fossils collected by Shell Canada Ltd. in 1960. Section measured north of the Sikanni Chief River, four miles south-southeast of the summit of Mount Helen.

<u>Footage</u>	<u>Collection</u>	<u>Fossil Identification</u>	<u>Age</u>
0	? Top of Silurian (and Ordovician?) dolomite unit		
35-45	S 16011	* <u>Favosites</u> sp. (1-1 1/2 mm. corallites) (continued)	Silurian or Devonian



		<p>favositid coral (2 1/2-3 mm. corallites) lithistid sponge undet.</p>	
155-65	S 16014	<p>halysitid coral <u>Multisolenia</u> sp.</p>	Silurian
275-85	S 16021	<p>*<u>Cystihalysites</u> sp. (2 1/2 x 2 mm. autocorallites)</p>	Silurian
300-10	S 16022	<p><u>Pentamerus</u> sp.</p>	Late Llandov- erian or Wenlockian
420-30	S 16023	<p><u>Cystihalysites</u> sp. (2 x 1 1/2 mm. autocorallites) solitary coral undet.</p>	
470-80	S 16024	<p><u>Cystihalysites</u> sp. (2 x 1 1/2 mm. autocorallites) <u>Halysites</u> (<u>Densoporites</u>) <u>compactus</u> Rominger *aff. <u>Syringopora</u> sp. (3/4 - 1 mm. corallites, no tabulae seen) solitary coral undet.</p>	Late Llandov- erian or Wenlockian
515-30	S 16025	<p>?<u>Amphipora</u> sp. <u>Favosites</u> sp. (1 1/2 - 2 mm. corallites) *<u>Syringopora</u> <u>verticillata</u> Goldfuss *solitary coral undet. *<u>Pentamerus</u> sp. *rhynchonellid brachiopod undet. <u>Euomphalus</u> sp. <u>Hormotoma</u> sp. planitrochid gastropod</p>	Late Llandov- erian or Wenlockian
565-75	S 16026	<p>*<u>Cystihalysites</u> sp. (2 1/2 x 2 auto- corallites) favositid coral *? <u>Pentamerus</u> sp.</p>	Late Llandov- erian or Wenlockian
1030-50	S 16027	<p>*<u>Palaeofavosites</u> sp. (1 1/2 - 2 mm. corallites) *<u>Pentamerus</u> sp.</p>	probably Llandoveryian



1085-1110	S 16028	*solitary coral undet. *? <u>Gypidula</u> sp. * <u>Pentamerus</u> sp. *pentamerid brachiopod	probably Llandoveryian
1425-50	S 16029	*? <u>Asthenophyllum</u> sp. * <u>Catenipora</u> sp. (1 x 3/4 mm. corallites) favositid coral <u>Palaeofavosites</u> sp. (1 - 1 1/2 mm. corallites) solitary coral *? <u>Clorinda</u> sp. *brachiopod undet.	probably Silurian, possibly Late Ordovician
1589	Top of Silurian and (or) Ordovician sandstone unit		
2043	Top of Ordovician dolomite unit		
2519-48	S 16030	<u>Orthoceras</u> sp. ? <u>Vaginoceras</u> sp.	probably Middle Ordovician

SOUTH SIKANNI CHIEF RIVER SECTION. (57° 09' 55"N, 123° 44' 55"W to 57° 11' 00"N, 123° 45' 45"W)

Section measured south of the Sikanni Chief River, five miles north of the summit of Mount McCusker.

a) Fossils collected by Shell Canada Ltd. in 1960.

<u>Footage</u>	<u>Collection</u>	<u>Fossil Identifications</u>	<u>Age</u>
	Silurian and (or) Ordovician sandstone unit (incomplete)		
47	Top of Ordovician dolomite unit		
476-506 Talus	S 16143	<u>Eofletcheria</u> sp. <u>Liospira</u> sp. endocerid cephalopod echinoderm columnals	Middle Ordovician
538-68	S 16139	<u>Receptaculites</u> sp. sponge undet. stromatoporoid gastropod	Middle Ordovician



721-47	S 16144	<u>Eofletcheria</u> sp. endocerid cephalopod	Middle Ordovician
999-1027	S 16141	echinoderm columnals	
1368	Top of Mount April Formation		
1809-32	S 16140	orthid brachiopod <u>? Bellefontia</u> sp.	Canadian

b) Fossils collected by Pan American Petroleum Corporation in 1961

<u>Footage</u>	<u>Fossil Identifications</u>	<u>Age</u>
0	Top of Ordovician dolomite unit	
0-10	<u>Receptaculites</u> sp. <u>? Lingulella</u> sp. <u>Orbiculoidea</u> sp. <u>? Rafinesquina</u> sp. <u>? Sowerbyella</u> sp. rhynchonellid brachiopod	probably Middle Ordovician
440	gastropod	
670	colonial coral <u>? endocerid cephalopod</u> orthid brachiopod	probably Middle Ordovician
703	colonial coral	Middle Ordovician
880	<u>Beatricea</u> sp.	
965	gastropod echinoderm columnals	
1110	<u>Raphistomina</u> sp	
1314	Top of Mount April Formation	
1735	<u>? Orthidiella</u> sp. orthid brachiopod gastropod trilobite <u>? conulariid</u>	probably Canadian



2075	orthid brachiopod	
2330	? <u>Hesperonomia</u> sp. orthid brachiopods ? <u>Bellefontia nonius</u> Walcott	Canadian
2515	? <u>Lingulella</u> sp. brachiopod	

MOUNT KENNY SECTION 1. (56° 57' 30"N, 123° 45' 45"W to 56° 58' 00"N  
123° 45' 25"W)

Fossils collected by Shell Canada Ltd. in 1960. Section measured along ridge north of summit of Mt. Kenny.

<u>Footage</u>	<u>Collection</u>	<u>Fossil Identifications</u>	<u>Age</u>
	Devonian		
2262	? Top of Silurian dolomite unit		
2285-2305		halysitid coral	Silurian
2662-93	S 8449	<u>Cystihalysites</u> sp (2 x 1 1/2 mm. autocorallites) * <u>Favosites</u> sp. (2 1/2 mm. corallites) *solitary corals undet., 2 spp.	Silurian
2948-63	S 8455	* <u>Fletcheria deadwoodensis</u> Norford ? <u>Ptychophyllum</u> sp. *rhynchonellid brachiopod undet.	Late Llandov- erian or Wenlockian
3075-3110	S 8448	<u>Cystihalysites</u> sp. (2 1/2 x 2 mm. autocorallites) <u>Halysites</u> cf. <u>nitida</u> Lambe <u>Favosites</u> sp. (2 1/2 - 3 mm. corallites) F. sp. (1 1/2 - 2 mm. corallites) * <u>Heliolites</u> sp. ( 1 mm. corallites) * <u>Propora</u> ( <u>Lyellia</u> ) sp. (2 mm. corallites) * <u>Thamnopora</u> aff. " <u>Coenites</u> " <u>laqueta</u> Rominger stromatoporoid sponge undet. <u>Pentamerus</u> sp.	Late Llandov- erial or Wenlockian



3223-52	S 8454	<u>Favosites</u> sp. (2 1/2 mm. corallites) * <u>?F.</u> sp. (1 - 1 1/2 mm. corallites) favositid coral <u>Halysites</u> sp. (2 1/4 x 1 1/2 mm. autocorallites)	probably Late Llandoveryan or Wenlockian
3952-75	S 8456	* <u>Halysites</u> sp. (2 x 2 mm. autocorallites) * <u>halysitid</u> coral <u>Palaeofavosites</u> sp. (2 - 2 1/2 mm. corallites) echinoderm columnals	Llandoveryan
4315-42	S 8457	<u>Halysites</u> sp. (2 x 2 mm. corallites) * <u>Palaeofavosites</u> sp. (2 - 2 1/2 mm. corallites) euomphalid gastropod echinoderm columnals	Llandoveryan

MOUNT KENNY SECTION 2. (56° 55' 55"N, 123° 47' 15"W to 56° 56' 30"W,  
123° 46' 30"W)

Fossils collected by Shell Canada Ltd. in 1960. Section measured two miles east of the summit of Mt. Kenny.

<u>Footage</u>	<u>Collection</u>	<u>Fossil Identifications</u>	<u>Age</u>
	Silurian dolomite unit (incomplete)		
131-55	S 16043	<u>Favosites</u> sp. (2 1/2 mm corallites) <u>?Syringopora</u> sp.	probably Llandoveryan
187-218	S 16042	<u>Halysites</u> sp. (1 x 1 1/2 mm. autocorallites)	Silurian
250-70	S 16041	brachiopod echinoderm columnals	
325	Top of Silurian (and Ordovician?) mudstone unit		
675	?Top of Cloudmaker Formation		
675-94	S 16040	<u>Orthograptus calcaratus</u> cf. <u>basilicus</u>	probably <u>intermedius</u> Zone
836-63	S 16044	? <u>Climacograptus</u> sp. <u>Orthograptus</u> sp. indet. cf. <u>O. whitfieldi</u> gastropod	probably <u>bicornis</u> Zone



1215 Top of Ordovician dolomite unit

MOUNT KENNY SECTION 3. (56° 56' 25"N, 123° 49' 45"W to 56° 57' 35"N, 123° 50' 40"W)

fossils collected by Shell Canada Ltd. in 1960. Section measured along ridge three miles northeast of the summit of Mount Kenny.

<u>Footage</u>	<u>Collection</u>	<u>Fossil Identifications</u>	<u>Age</u>
	Cloudmaker Formation (incomplete)		
135	Top of Ordovician dolomite unit		
1530-1602	S 16039	<u>Liospira</u> sp. <u>Orthoceras</u> sp.	probably Middle Ordovician
1602-75	S 16038	euomphalid gastropod	
2297-2360	S 16037	<u>Maclurites</u> sp. murchisonid gastropod	probably Middle Ordovician
2508	Top of Mount April Formation		

TRAVERSE FROM CALNAN CREEK TO HALFWAY RIVER DIVIDE.

Fossils collected by the author in 1965.

Cloudmaker Formation. Outcrop at 56° 51' 25"N, 123° 44' 35"W.

<u>Collection</u>	<u>Fossil Identifications</u>	<u>Age</u>
ED 65141	dicranograptid graptolite indet. <u>Orthograptus</u> ex gr. <u>calcaratus</u> <u>O. aff. quadrimucronatus</u>	probably <u>intermedius</u> Zone

Cloudmaker Formation. Outcrop at 56° 51' 50"N, 123° 45' 10"W.

<u>Collection</u>	<u>Fossil Identifications</u>
ED 65147	<u>Climacograptus</u> sp. <u>Orthograptus</u> sp.



Ordovician dolomite unit. Talus at 56° 52' 20"N, 123° 45' 45"W.

<u>Collection</u>	<u>Fossil Identification</u>
ED 65145	aff. <u>Kochoceras</u> sp.

Ordovician dolomite unit. Talus at 56° 52' 20"N, 123° 45' 30"W.

<u>Collection</u>	<u>Fossil Identifications</u>
ED 65143	gastropod orthocerid cephalopod

SOUTH CALNAN CREEK COMPOSITE SECTION. (Measured in 4 parts on the south side of Calnan Creek: 0-1463' from 56° 50' 25"N, 123° 41' 35"W; to 56° 50' 40"N, 123° 42' 15"W; 1463' - 2485' from 56° 49' 40"W, 123° 42' 45"W to 56° 49' 50"N, 123° 43' 30"W; 2485' - 4195' from 56° 49' 15"N, 123° 47' 00"W to 56° 49' 50"N, 123° 45' 45"W; 4195' - 5650' from 56° 50' 05"N, 123° 43' 45"W to 56° 50' 20"N, 123° 43' 45"W.

a) Fossils collected by the author in 1965.

<u>Footage</u>	<u>Collection</u>	<u>Fossil Identifications</u>	<u>Age</u>
0	Top of Silurian siltstone unit		
200 Talus	ED 65120	* <u>Favosites</u> sp. (1 1/2 mm. corallites)	Silurian or Devonian
400 Talus	ED 65119	echinoderm columnals	
1463	Top of Silurian dolomite unit		
1468	ED 65117	*sponge undet. *brachiopod undet.	
1488	ED 65116	* <u>Halysites</u> cf. <u>sandpilensis</u> Norford	Llandoveryan
1518	ED 65114	echinoderm columnals	
1687	ED 65108	<u>Favosites</u> sp. (2 1/2 - 3 mm. corallites) <u>F.</u> sp. (1 - 1 1/2 mm. corallites)	Llandoveryan
1730	ED 65107	* <u>Heliolites</u> sp. (1 1/4 - 1 1/2 mm. corallites) solitary coral undet.	Llandoveryan



1830	Top of Silurian (and Ordovician?) mudstone unit		
2050-2200 Talus	ED 6599	<u>Climacograptus</u> sp. indet. <u>?Glyptograptus</u> sp.	
2240-70 Talus	ED 6597	<u>Climacograptus</u> sp. indet. <u>?Orthograptus vesiculosus</u> penna	<u>?modestus</u> Zone
2270-85 Talus	ED 6596	<u>Climacograptus</u> cf. <u>scalaris normalis</u> <u>?Glyptograptus</u> sp.	
2315-40 Talus	ED 6594	<u>Climacograptus</u> ex gr. <u>scalaris</u>	
2340-2400 Talus	ED 6593	<u>Climacograptus</u> cf. <u>medius</u> <u>Diplograptus</u> aff. <u>modestus</u> <u>Glyptograptus</u> cf. <u>tamariscus</u>	<u>?modestus</u> Zone
2400-50	ED 6592	<u>Climacograptus</u> sp. indet. <u>Diplograptus</u> aff. <u>modestus</u> <u>Glyptograptus</u> cf. <u>tamariscus</u>	<u>?modestus</u> Zone
2485	Top of quartzite member of Cloudmaker Formation		
2650-55	ED 65153	<u>Dicellograptus</u> sp. indet. <u>Dicranograptus</u> sp. indet. <u>Orthograptus quadrimucronatus</u> cf. <u>spinigerus</u> <u>O.</u> ex gr. <u>quadrimucronatus</u> <u>O.</u> ex gr. <u>truncatus</u> aff. <u>Oxlosia</u> sp.	<u>quadrimucronatus</u> Zone
2670-80 and 2690-2705	ED 65152	<u>Climacograptus</u> cf. <u>typicalis</u> <u>C.</u> sp. indet. <u>Dicellograptus</u> cf. <u>gurleyi</u> <u>Dicranograptus</u> <u>kirki</u> <u>D.</u> sp. indet. <u>Leptograptus flaccidus</u> <u>macer</u> <u>Orthograptus</u> ex gr. <u>calcaratus</u> <u>O.</u> <u>quadrimucronatus</u> <u>O.</u> <u>quadrimucronatus</u> cf. <u>spinigerus</u> <u>O.</u> ex gr. <u>truncatus</u> <u>O.</u> sp. indet.	<u>quadrimucronatus</u> Zone
2715-25	ED 65151	<u>Climacograptus</u> sp. indet.	
2750	Top of lower shale and siltstone member of Cloudmaker Formation		



3175-3250	ED 65134	<u>Climacograptus</u> sp. indet.	
3250-3325	ED 65133	<u>Climacograptus</u> sp. indet. <u>Dicranograptus</u> sp. indet. <u>Orthograptus truncatus intermedius</u> <u>O. truncatus pauperatus</u> <u>O. sp. indet.</u>	<u>intermedius</u> Zone
3350-75	ED 65136	<u>Orthograptus</u> sp. indet.	
3405-25	ED 65137	<u>Dicellograptus</u> sp. indet. <u>Orthograptus</u> sp. indet.	
3470-80	ED 65138	? <u>Dicellograptus</u> sp. ? <u>Orthograptus</u> sp.	
3480-3500	ED 65139	<u>Dicranograptus nicholsoni</u>	
3530-40	ED 65140	<u>Climacograptus bicornis</u> <u>Dicranograptus nicholsoni</u> ? <u>Orthograptus</u> sp.	<u>bicornis</u> Zone
3540-60	ED 65129	<u>Climacograptus bicornis</u> <u>Dicranograptus nicholsoni</u> <u>Leptograptus</u> sp. indet. ? <u>Nemagraptus</u> sp. <u>Orthograptus calcaratus acutus</u>	<u>bicornis</u> Zone
3600-15	ED 65128	<u>Climacograptus bicornis</u> <u>Dicellograptus</u> sp. indet. <u>Dicranograptus contortus</u> <u>D. nicholsoni</u> <u>Orthograptus</u> sp. indet.	<u>bicornis</u> Zone
3615-25	ED 65127	<u>Climacograptus bicornis</u> <u>C. sp. indet.</u> <u>Dicellograptus</u> sp. indet. <u>Dicranograptus nicholsoni geniculatus</u> <u>D. sp. indet.</u> ? <u>Nemagraptus</u> sp. <u>Orthograptus calcaratus acutus</u> <u>O. cf. whitfieldi</u>	<u>bicornis</u> Zone
4050		inarticulate brachiopod	
4195	Top of Ordovician dolomite unit		



Talus                      gastropods  
                                  orthoconic cephalopods  
                                  echinoderm columnals

b) Fossils collected by Shell Canada Ltd. in 1960. Respective rock units measured at same locations.

<u>Footage</u>	<u>Collection</u>	<u>Fossil Identifications</u>	<u>Age</u>
	Devonian		
918	Top of Silurian siltstone unit		
1158-86 Talus	S 16138	* <u>Favosites</u> sp. (1 1/2 mm corallites)	Silurian or Devonian
2145-74	S 21104	<u>Monograptus</u> cf. <u>dubius</u>	probably Wenlockian
2440	Top of Silurian dolomite unit		
2479-2512	S 16133	<u>Cystihalysites</u> sp. (2 1/2 x 2 mm. autocorallites) <u>Favosites</u> sp. (2 - 2 1/2 mm. corallites) *solitary coral undet.	Llandoveryan
2845	Top of Silurian (and Ordovician?) mudstone unit		
3443	Top of quartzite member of Cloudmaker Formation		
3713	Top of lower shale and siltstone member of Cloudmaker Formation		
4230-73	S 16136	<u>Climacograptus</u> sp. indet. <u>Orthograptus truncatus intermedius</u>	<u>intermedius</u> Zone
4552-75	S 16137	<u>Climacograptus bicornis</u> <u>Dicranograptus nicholsoni</u> <u>Orthograptus calcaratus acutus</u>	<u>bicornis</u> Zone
4692-4722	S 16131	<u>Climacograptus bicornis</u> <u>Dicellograptus</u> sp. indet. <u>Dicranograptus nicholsoni geniculatus</u> <u>Orthograptus calcaratus acutus</u>	<u>bicornis</u> Zone
5410	Top of Ordovician dolomite unit		



SPOT COLLECTION NORTH OF SLADE CREEK. (56° 49' 00"N, 123° 43' 35"W)

Fossils collected by the author in 1965. Collection from shale bed in basal part of quartzite member of Cloudmaker Formation.

<u>Collection</u>	<u>Fossil Identifications</u>	<u>Age</u>
ED 6590	<u>Dicranograptus cf. kirki</u> <u>Orthograptus sp. indet.</u>	probably <u>quadrimucronatus</u> Zone

TRAVERSE SOUTH OF SLADE CREEK.

Fossils collected by the author in 1965.

Silurian dolomite unit. Outcrop at 56° 47' 40"N, 123° 42' 50"W. Collection 7' above the base of the unit.

<u>Collection</u>	<u>Fossil Identification</u>	<u>Age</u>
ED 6573	* <u>Catenipora</u> sp. (2 x 1 1/2 mm. corallites)	Llandoveryan

Silurian (and Ordovician?) mudstone unit. Talus collection at 56° 47' 50"N, 123° 42' 40"W. Unit slightly metamorphosed.

<u>Collection</u>	<u>Fossil Identification</u>
ED 6571	diplograptid graptolite indet.

Silurian (and Ordovician?) mudstone unit. Talus collection at 56° 48' 00"N, 123° 42' 30"W.

<u>Collection</u>	<u>Fossil Identification</u>
ED 6560	euomphalid gastropod indet.

SOUTH SLADE CREEK SECTION. (56° 47' 25"N, 123° 41' 25"W, to 56° 47' 15"N, 123° 41' 55"W)

Fossils collected by the author in 1965. Section measured along ridge south of Slade Creek.

<u>Footage</u>	<u>Collection</u>	<u>Fossil Identifications</u>	<u>Age</u>
		Silurian siltstone unit (incomplete)	



405	ED 6582	<u>Monograptus</u> sp. indet. worm burrows	
525	ED 6575	*? <u>Columnaria</u> sp. (6 mm. corallites, very short septa) * <u>Fletcheria</u> sp. (3 mm. corallites) <u>Craterophyllum</u> aff. <u>invaginatum</u> (Davis) sponge reticulate gastropod echinoderm columnals	Late Llandov- erian or Wenlockian
670	Top of Silurian dolomite unit		

TRAVERSE ALONG RIDGE NORTH OF LADY LAURIER LAKE.

Silurian siltstone unit. Outcrop at 56° 43' 20"N, 123° 44' 20"W. Collection at base of unit.

<u>Collection</u>	<u>Fossil Identifications</u>	<u>Age</u>
ED 6539	? <u>Barrandeograptus</u> sp. <u>Dictyonema</u> sp. indet. <u>Monograptus</u> ex gr. <u>prionon</u> <u>M.</u> cf. <u>spiralis</u> <u>M.</u> spp. indet.	probably <u>spiralis</u> Zone

Silurian dolomite unit. Outcrop at 56° 43' 20"N, 123° 44' 25"W. Collection at top of unit.

<u>Collection</u>	<u>Fossil Identifications</u>	<u>Age</u>
ED 6538	<u>Favosites</u> sp. (2 1/2 mm. corallites) <u>F.</u> sp. (1 1/2 mm. corallites) halysitid coral (unextractable from outcrop) *? <u>Ptychophyllum</u> sp. * <u>Striatopora</u> sp. (1 mm. calyxes) *solitary coral undet. stromatoporoid	probably Late Llandoveryan

Silurian dolomite unit. Talus at 56° 43' 20"N, 123° 44' 35"W. Collection near base of unit.

<u>Collection</u>	<u>Fossil Identifications</u>	<u>Age</u>
ED 6537	* <u>Catenipora simplex</u> (Lambe) (continued)	Llandoveryan



Halysites sp. (1 1/4 x 1 mm. autocorallites)  
 \*? Favosites sp. (2 1/2 mm. corallites)  
F. sp. (1 - 1 1/2 mm. corallites)  
 \* Palaeofavosites sp. (1 mm. corallites)  
 \* tabulate coral undet.  
 \* tubular, tabulate coral undet.  
 \* solitary coral undet.  
 \*? Hesperorthis sp.  
Lophospira sp.  
 orthocerid cephalopod  
 echinoderm columnals

SOUTH LADY LAURIER LAKE COMPOSITE SECTION. (Measured in two parts south of Lady Laurier Lake: 0-1110' from 56° 40' 00"N, 123° 42' 45"W to 56° 40' 00"N, 123° 43' 15"W; 850'-2900' from 56° 41' 20"N, 123° 45' 00"W, to 56° 40' 50"N, 123° 46' 00"W.

Fossils collected by the author in 1965.

<u>Footage</u>	<u>Collection</u>	<u>Fossil Identifications</u>	<u>Age</u>
0	Top of quartzite member of Cloudmaker Formation		
282-85	ED 6529	<u>Climacograptus caudatus</u> <u>C. cf. spiniferus</u> <u>C. sp.</u> <u>Dicellograptus sp. indet.</u> <u>Dicranograptus kirki</u> dicranograptid graptolite indet. <u>Leptograptus sp. indet.</u> <u>Orthograptus quadrimucronatus</u> <u>O. quadrimucronatus spinigerus</u> <u>O. ex gr. quadrimucronatus</u> <u>O. truncatus cf. intermedius</u> aff. <u>Oxlosia</u> sp.	<u>quadrimucronatus</u> <u>Zone</u>

Top of lower shale and siltstone member of Cloudmaker Formation

590-620	ED 6518	? <u>Climacograptus</u> sp. <u>Dicranograptus</u> sp. indet.
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(Note: all the following fossil collections are from the northern part of this composite section)

800 Talus	ED 6516	dicranograptid graptolite
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860 Talus	ED 656	<u>Dicranograptus nicholsoni</u>	
950 Talus	ED 654	<u>Climacograptus</u> sp. indet.	
990 Talus	ED 651	<u>Glyptograptus</u> sp. indet.	
1010 Talus	ED 652	<u>Climacograptus</u> cf. <u>bicornis</u> <u>Dicranograptus nicholsoni</u>	probably <u>bicornis</u> Zone
1040 Talus	ED 6540	<u>Dicranograptus</u> cf. <u>ramosus</u> <u>longicaulis</u> <u>Glyptograptus</u> sp. indet.	probably <u>bicornis</u> Zone
1110	Top of Ordovician dolomite unit		
1502-50	ED 6545	large solitary coral or sponge (unextract- able from outcrop) macluritid gastropod	
1586-1725	ED 6547	<u>Maclurites</u> sp.	probably Middle Ordovician
1725-1970	ED 6548	macluritid gastropod	
2022-2111	ED 6550	<u>Maclurites</u> sp.	probably Middle Ordovician

SPOT COLLECTION SOUTH OF LADY LAURIER LAKE. (56° 40' 45"N, 123° 43' 05"W)

Fossils collected by the author in 1965. Collection from Silurian siltstone unit near contact (probably faulted) with Silurian dolomite unit.

<u>Collection</u>	<u>Fossil Identification</u>
ED 6511	<u>Monograptus</u> sp.



TRAVERSE ALONG RIDGE SOUTH OF GAUVREAU CREEK.

Fossils collected by Shell Canada Ltd. in 1960.

? Ordovician dolomite unit. Outcrop at  $56^{\circ} 18' 30''\text{N}$ ,  $123^{\circ} 41' 15''\text{W}$ .

<u>Collection</u>	<u>Fossil Identifications</u>	<u>Age</u>
S 15147	solitary coral sponge undet. <u>Maclurites</u> sp. gastropod <u>Michelinoceras</u> sp. pelecypod	Porterfieldian or Late Ordovician

Ordovician dolomite unit. Outcrop at  $56^{\circ} 18' 45''\text{N}$ ,  $123^{\circ} 40' 15''\text{W}$ .  
Collection near base of unit.

<u>Collection</u>	<u>Fossil Identifications</u>	<u>Age</u>
S 15138	<u>Lichenaria</u> sp. sponge undet. <u>Bimuria buttsi</u> Cooper <u>Orthambonites</u> sp. undet. plectambonitid brachiopod undet. <u>Ceratopea</u> sp. gastropod aff. <u>Kochoceras</u> sp. echinoderm columnals	probably mixed collection which includes Early and Middle Ordovician

? Ordovician dolomite unit. Outcrop at  $56^{\circ} 18' 30''\text{N}$ ,  $123^{\circ} 40' 00''\text{W}$ .

<u>Collection</u>	<u>Fossil Identifications</u>	<u>Age</u>
S 15146	<u>Orthambonites</u> cf. <u>subconvexus</u> Cooper <u>O.</u> cf. <u>marshalli</u> (Wilson) orthid brachiopod undet.	probably Whiterockian

ADVANCE MOUNTAIN SECTION. ( $56^{\circ} 03' 00''\text{N}$ ,  $123^{\circ} 28' 00''\text{W}$  to  $56^{\circ} 02' 50''\text{W}$ ,  
 $123^{\circ} 25' 00''\text{W}$ )

Section measured along the crest of Advance Mountain.

a) Fossils collected by Hudson's Bay Oil and Gas Company Ltd. in 1960.  
Identifications by Dr. J. Usher.



<u>Footage</u>	<u>Fossil Identifications</u>	<u>Age</u>
	Devonian dolomite unit (incomplete)	
735	? Top of Silurian and Ordovician dolomite unit	
930	<u>Chonophyllum</u> sp. indet. <u>? Dinophyllum</u> sp. <u>Favosites</u> spp. indet. stromatoporoid <u>Cyrtina</u> sp. indet.	Silurian
950-55	<u>Catenipora</u> aff. <u>gracilis</u> Hall <u>Favosites</u> sp. indet. <u>Heliolites</u> sp. indet.	Silurian
1305	<u>Favosites</u> sp. indet. <u>Halysites</u> cf. <u>catenularia</u> (Linnaeus) <u>? Streptelasma</u> sp.	Silurian
1385	<u>Favosites</u> sp. indet.	
1530-1615	<u>Favosites</u> sp. <u>Halysites</u> sp. <u>? Syringopora</u> sp. solitary corals	Silurian
2040	<u>Favosites</u> sp. indet.	
2200	<u>Favosites</u> sp. indet. <u>Dinorthis</u> sp. <u>Resserella</u> cf. <u>tersa</u> (Sardeson) <u>Hormotoma</u> sp. undet. <u>Lophospira</u> cf. <u>acuminatus</u> (Ulrich and Scofield) <u>? Orthoceras</u> sp. pelecypod indet. echinoderm columnals	Late Ordovician
2315	Top of Ordovician sandstone unit	
2425	Top of Ordovician argillaceous carbonate unit	
2470-2510	bryozoan undet. <u>Cyclospira</u> aff. <u>bisulcata</u> (Emmons) <u>Lepidocyclus</u> cf. <u>erectus</u> Wang (continued)	Late Ordovician



L. cf. rectangularis Wang  
Sowerbyella cf. rugosa (Meek)  
Strophomena cf. amoena Wang  
S. sp. indet.  
 gastropod indet.  
 echinoderm columnals

2510-35	<u>Resserella tersa</u> (Sardeson) <u>Strophomena aff. planumbona</u> (Hall)	Late Ordovician
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2595-2615	<u>Lepidocyclus cf. erectus</u> Wang <u>L. rectangularis</u> Wang <u>Platystrophia</u> spp. indet. <u>Resserella tersa</u> (Sardeson) <u>Strophomena aff. nutans</u> (Meek) <u>S. cf. neglecta</u> James echinoderm columnals	Late Ordovician
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2615-35	bryozoan undet. <u>Diceromyonia tersa</u> (Sardeson) <u>Lepidocyclus erectus</u> Wang <u>Opikina limbrata</u> Wang <u>Rafinesquina cf. loxorhytis</u> (Meek) <u>Resserella sp. indet.</u> <u>Strophomena amoena</u> Wang <u>S. cf. neglecta</u> James	Late Ordovician
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2710	Top of Ordovician dolomite unit
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b) Fossils collected by Shell Canada Ltd. in 1960.

<u>Footage</u>	<u>Collection</u>	<u>Fossil Identifications</u>	<u>Age</u>
	Devonian (incomplete)		
4270	? Top of Silurian and Ordovician dolomite unit		
4843-77	S 16322	<u>Amphipora</u> sp. <u>Favosites</u> sp. (2 1/2 - 3 mm. corallites) halysitid coral solitary coral stromatoporoid *zygospirid brachiopod	Silurian
5054-85	S 16321	? <u>Amphipora</u> sp. ? sponge	probably Silurian



5413-54	S 16319	<u>Halysites</u> sp. (2 x 1 1/2 mm. autocorallites) *tubular, tabulate coral undet. (1 1/2 - 2 mm. corallites, flat tabulae) stromatoporoid echinoderm columnals	Silurian
5454-87	S 16318	*favositid coral *halysitid coral *stromatoporoid *echinoderm columnals	
5573-5603	S 16320	halysitid coral *orthid brachiopod	
5650	Top of Ordovician sandstone unit		
5750	Top of Ordovician argillaceous carbonate unit		
5813-40	S 16317	*solitary coral bryozoan ? <u>Diceromyonia</u> sp. <u>Strophomena</u> sp. ? <u>Thaerodonta</u> sp. echinoderm columnals	Ordovician

SOUTH ADVANCE MOUNTAIN SECTION. (56° 02' 30"N, 123° 25' 00"W to 56° 01' 55"N, 123° 25' 00"W)

Fossils collected by Shell Canada Ltd. in 1960. Section measured on the south face of Advance Mountain.

<u>Footage</u>	<u>Collection</u>	<u>Fossil Identifications</u>	<u>Age</u>
	Devonian (incomplete)		
890	?Top of Silurian and Ordovician dolomite unit		
1392-1640	S 16326	favositid coral * <u>Halysites</u> sp. (1 1/4 x 1 1/2 mm. autocorallites)	Silurian
1949-2070	S 16327	favositid coral solitary coral *? <u>Glassia</u> sp.	probably Silurian



2070-2273	S 16328	favositid coral halysitid coral <u>Halysites</u> sp. (1 1/4 x 1 mm autocorallites) *solitary coral * <u>Atrypa parva</u> Hume	probably Late Llandoveryan
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2400            ?Top of Ordovician sandstone unit

WEDGE PEAK SECTION. (56° 03' 25"N, 123° 32' 00"W to 56° 02' 15"N, 123° 32' 00"W)

Fossils collected by Hudson's Bay Oil and Gas Company Ltd. in 1960. Section measured on the south face of Wedge Peak. Fossils identified by Dr. J. Usher.

<u>Footage</u>	<u>Fossil Identifications</u>	<u>Age</u>
	Devonian dolomite unit (incomplete)	
1260	?Top of Silurian and Ordovician dolomite unit	
1875-1930	favositid coral <u>Halysites</u> sp. indet.	Silurian
2485	<u>Favosites</u> sp. indet. <u>Halysites</u> sp. indet. solitary corals gastropods echinoderm columnals	Silurian
2745	Top of Ordovician sandstone unit	
2760-2825	<u>Dalmanella</u> sp. undet. <u>Opikina limbrata</u> Wang <u>Rafinesquina</u> cf. <u>alternata</u> (Conrad) <u>Strophomena</u> sp. indet.	Late Ordovician
2800	Top of Ordovician argillaceous carbonate unit	
2900-3070	? <u>Hormotoma</u> sp.	
3080	Top of Ordovician dolomite unit	



CLEARWATER CREEK SECTION. (55° 49'N, 123° 15'W)

Fossils collected and identified by Dr. B.S. Norford of the Geological Survey of Canada. Section measured in the Pine Pass Map-area in 1961.

<u>Footage</u>	<u>Collection</u>	<u>Fossil Identifications</u>	<u>Age</u>
	Middle Devonian		
756	Top of Silurian and Ordovician dolomite unit		
2276	GSC 45566	<u>Favosites</u> spp. autoporoid coral solitary coral brachiopod	probably Silurian
2431-46	GSC 45614	<u>Columnaria columbia</u> Norford <u>Favosites</u> aff. <u>biloculi</u> Hall <u>F.</u> spp. solitary corals stromatoporoid	Late Llandoveryan
2431-91	GSC 45567	<u>Columnaria columbia</u> Norford <u>halysitid</u> coral	Late Llandoveryan
2459-74	GSC 45613	<u>Coenites</u> sp. <u>Favosites</u> aff. <u>biloculi</u> Hall <u>?F.</u> sp.	probably Late Llandoveryan
2521-41	GSC 45562	<u>Favosites</u> sp. <u>halysitid</u> coral solitary coral stromatoporoid	Silurian
2556	Top of Ordovician		
2840-69	GSC 45561	<u>Bighornia</u> sp. <u>Lobocorallium</u> aff. <u>trilobatum</u> (Whiteaves) <u>?Grewingkia</u> sp. <u>?Palaeofavosites</u> spp. <u>?Hesperorthis</u> sp. <u>Rhynchotrema</u> <u>increbescens</u> <u>occidens</u> Wilson <u>R.</u> sp.	Richmondian <u>Bighornia-</u> <u>Thaerodonta</u> <u>Fauna</u>
2846-71	GSC 45564	<u>Bighornia</u> sp. <u>?Catenipora</u> sp. <u>Lobocorallium</u> aff. <u>trilobatum</u> (Whiteaves) <u>Palaeofavosites</u> sp. <u>?Palaeophyllum</u> sp. <u>Sarcinula</u> sp. <u>?Tollina</u> sp. autoporoid coral bryozoan <u>?Onniella</u> sp. <u>Rhynchotrema</u> <u>increbescens</u> <u>occidens</u> Wilson	Richmondian <u>Bighornia-</u> <u>Thaerodonta</u> <u>Fauna</u>



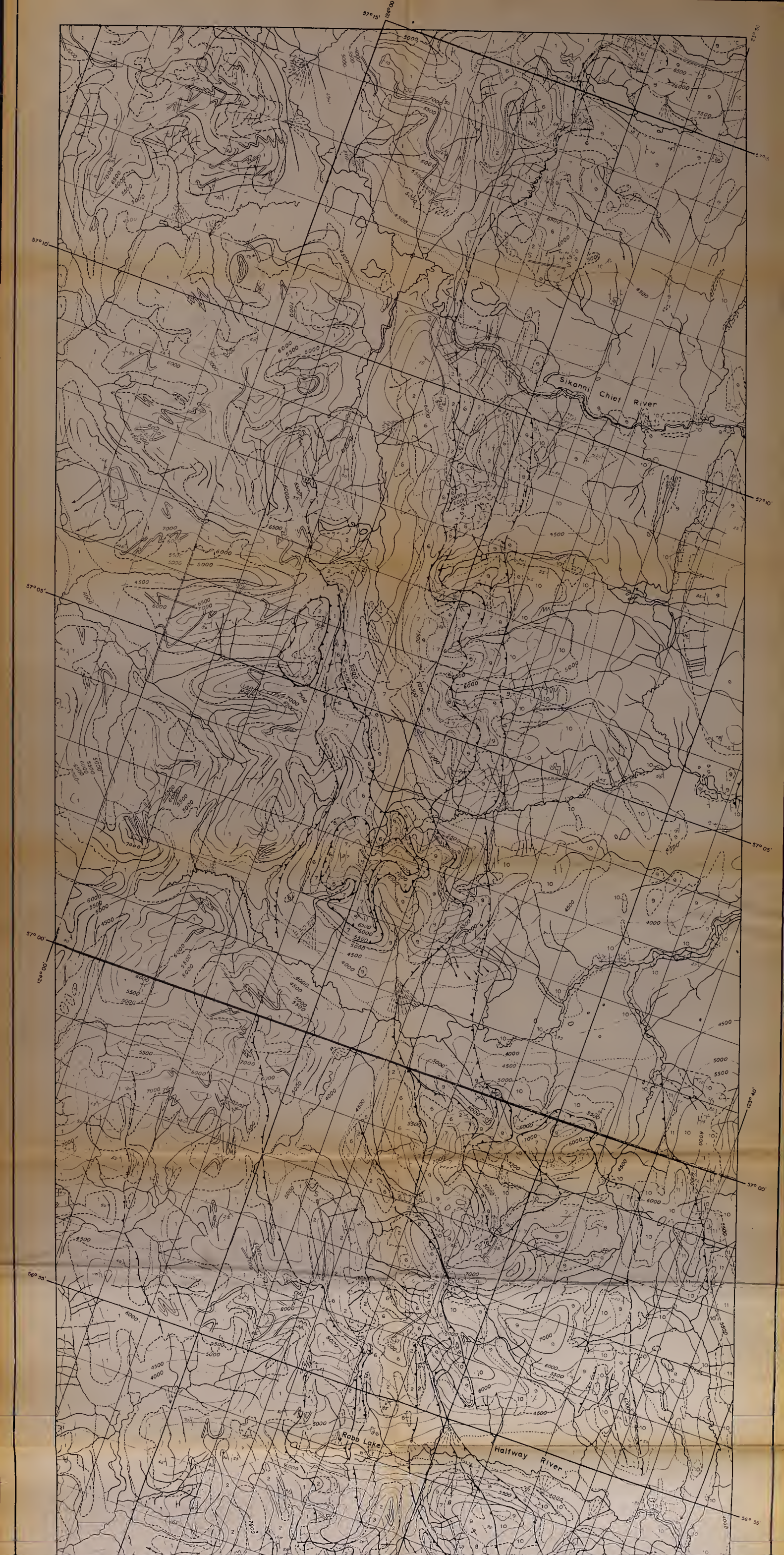
3039-41	GSC 45517	<u>Catenipora</u> sp. solitary coral bryozoan brachiopods	probably Barneveldian to Richmondian
3112-17	GSC 45565	<u>Orthambonites</u> cf. <u>marshalli</u> (Wilson) aff. <u>Orthidiella</u> sp. orthid brachiopod	probably Whiterockian











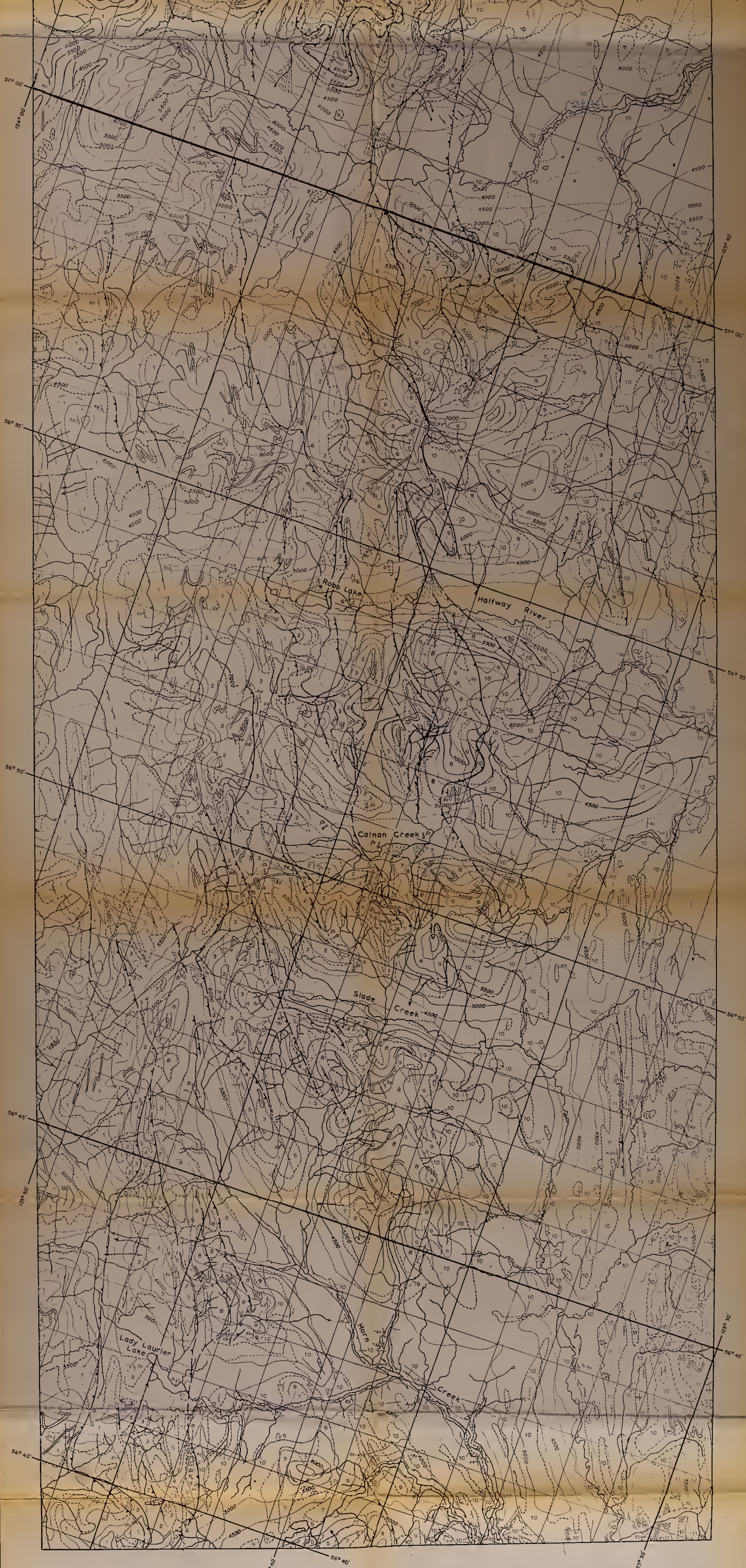
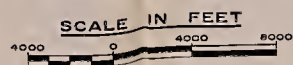


Figure 12

# THE GEOLOGY OF THE HALFWAY RIVER AREA NORTH - EASTERN BRITISH COLUMBIA



## LEGEND

### MISSISSIPPIAN

- [12] Stoddart Formation  
Sandstone, siltstone, shale, and limestone.
- [11] Rundle Formation  
Bioclastic limestone; in lower part nodular with bedded black chert.

### MISSISSIPPIAN AND DECAHAN

### Outcrop

### Geological boundary

Beading (horizontal, inclined, undulatory, vertical, overturned)

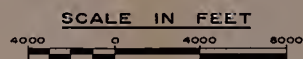
### Prominent bed

+



Figure 12

# THE GEOLOGY OF THE HALFWAY RIVER AREA NORTH - EASTERN BRITISH COLUMBIA



## LEGEND

### MISSISSIPPIAN

- [2] Stoddart Formation  
Sandstone, siltstone, shale, and limestone.
- [1] Rundle Formation  
Bioclastic limestone; in lower part nodular with bedded black chert.

### MISSISSIPPIAN AND DEVONIAN

- [10] Besa River Formation  
Black shale.

### DEVONIAN

- [9] Devonian carbonates  
Dolomite, sandy dolomite, and limestone.

### SILURIAN

- [8] Silurian siltstone unit  
Siltstone, dark grey, weathers brown, calcareous or dolomitic, laminated.
- [7] Silurian dolomite unit  
Dolomite, medium grey, weathers same, abundant argillaceous dolomite lithoclasts in part, sandy in part, silicified corals, resistant.

### South of Halfway River

### SILURIAN AND ORDOVICIAN(?)

- [9] Silurian mudstone unit  
Mudstone, dark grey, weathers medium grey, silty, calcareous or dolomitic, graphitic; base may be Upper Ordovician.

### ORDOVICIAN

- [4] Ordovician quartzite unit  
Quartzite, light to medium grey, weathers white to grey and brown, graphitic shale interbeds in lower part, resistant.
- [3] Ordovician shale unit  
Shale and siltstone, dark grey, weathers same to brown, calcareous, graphitic, recessive.

### ORDOVICIAN

- [2] Ordovician dolomite unit  
Dolomite, medium grey, weathers same, algal balls, gastropods, resistant.

### ORDOVICIAN AND CAMBRIAN(?)

- [1] Mount April Formation  
Limestone, medium grey, weathers light grey to brown, argillaceous, slaty cleavage.

### North of Halfway River

### SILURIAN AND ORDOVICIAN

- [6] Siluro-Ordovician unit  
General mapping unit which includes all strata between Ordovician dolomite unit (3) and Silurian dolomite unit (7). Between Halfway River and 57th parallel, consists of mudstone unit and underlying shale unit which are probably separated by an unconformity. North of 57th parallel, consists of argillaceous dolomite unit which is underlain by a quartzite unit. This quartzite is probably separated from the underlying Ordovician dolomite unit by an unconformity.

### Outcrop

### Geological boundary

### Beading (horizontal, inclined, undulatory, vertical, overturned)

### Prominent bed

### Axis of overturned anticline

### Foliation

### Thrust fault (position known, approximate, uncertain)

### Normal fault

### Measured section with fossil collections

### Fossil locality (spot collection)

### Photograph

### Scarp

### Dip slope

### Alluvial fan

### Contour interval 500 feet

FIELD MAPPING BY PA ZIEGLER, SHELL CANADA LTD IN 1960

HAWORTH LAKE,  
CLOUDMAKER MT.,  
NORTH CHESTERFIELD LAKE  
57° 45' N, 125° 07' W

NORTH AKIE RIVER  
57° 22' N, 124° 35' W

SOUTH CALMAN CREEK  
56° 50' N, 123° 45' W

S. LADY LAURIER LAKE  
56° 40' N, 123° 45' W

ADVANCE MT.,  
WEDGE PEAK  
56° 03' N, 123° 30' W

37 miles

4.9 miles

11 miles

4.5 miles



SANDPILE GROUP

CLOUDMAKER FORMATION

MOUNT APRIL FORMATION

upper shale and siltstone member  
quartzite member

lower shale and siltstone member



Datum: Base

FOSSIL CONTROL  
2 probably coralline member  
1 Upper Ordovician

# NOTE

Broken lines denote uncertainty  
Standard lithological symbols are  
Line of cross section is shown in

Scale:

Lithological sections 1 inch = 50'

(Distribution of rock units between

Horizontal Scale 1 inch = 5 miles

FOSSIL CONTROL  
9 probably intermedius Zone  
8 probably intermedius Zone  
7 probably intermedius Zone  
6 probably intermedius Zone  
5 probably intermedius Zone  
4 probably intermedius Zone  
3 probably intermedius Zone  
2 probably intermedius Zone  
1 probably intermedius Zone

FOSSIL CONTROL  
12 probably intermedius Zone  
11 probably intermedius Zone  
10 probably intermedius Zone  
9 probably intermedius Zone  
8 probably intermedius Zone  
7 probably intermedius Zone  
6 probably intermedius Zone  
5 probably intermedius Zone  
4 probably intermedius Zone  
3 probably intermedius Zone  
2 probably intermedius Zone  
1 probably intermedius Zone

FOSSIL CONTROL  
8 probably intermedius Zone  
7 probably intermedius Zone  
6 probably intermedius Zone  
5 probably intermedius Zone  
4 probably intermedius Zone  
3 probably intermedius Zone  
2 probably intermedius Zone  
1 probably intermedius Zone

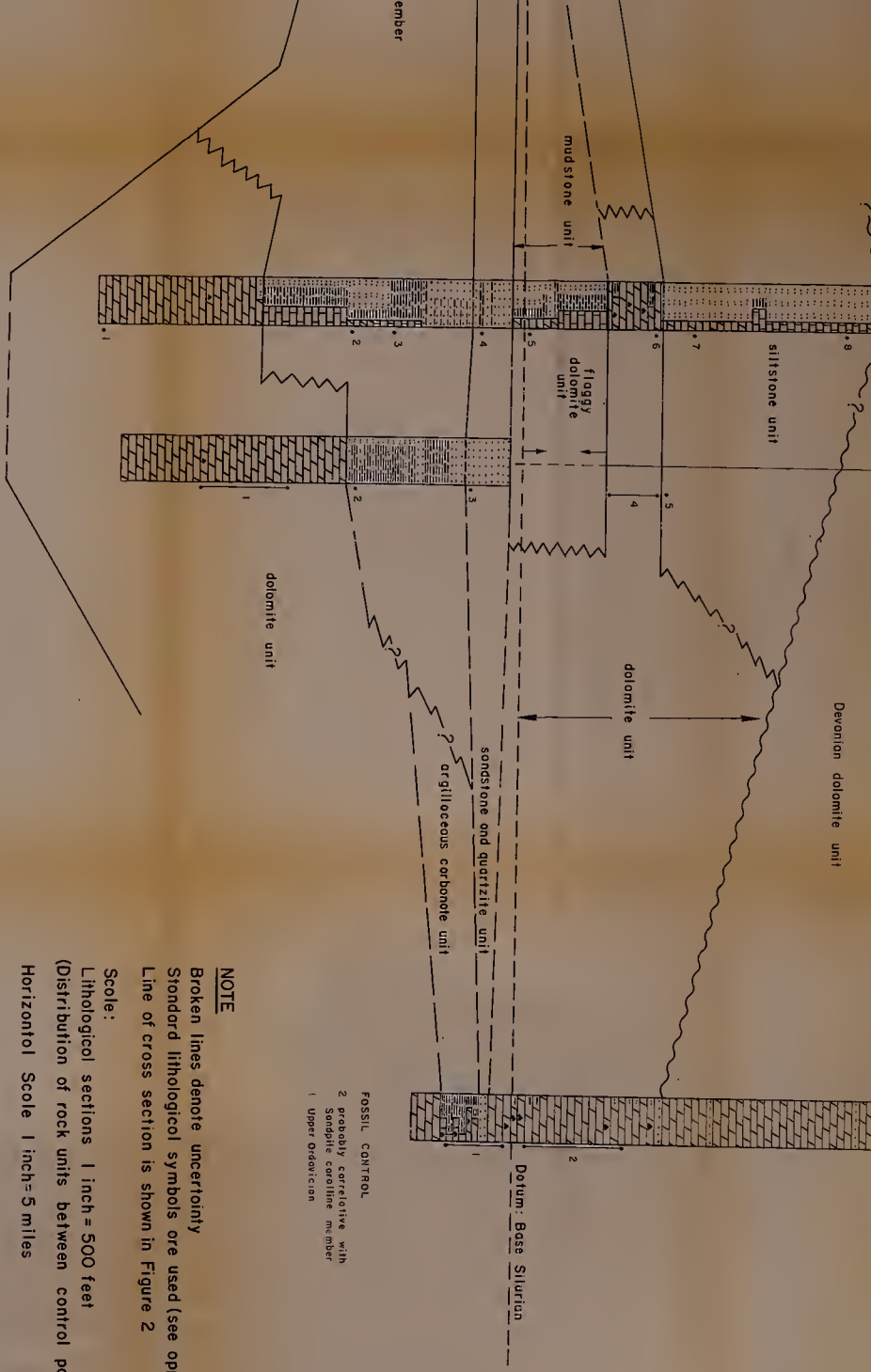
FOSSIL CONTROL  
5 probably intermedius Zone  
4 probably intermedius Zone  
3 probably intermedius Zone  
2 probably intermedius Zone  
1 probably intermedius Zone

# DEVONIAN AND SILURIAN OF THE NORTHERN ROCKY MOUNTAINS

- FOSSIL CONTROL

  - 8 Fossils sp. undet.
  - 7 probably Wenlockian
  - 6 probably coralline with Saccophylloids
  - 5 Zonitoid Zone
  - 4 goniatitoid Zone
  - 3 intermediate Zone
  - 2 Bellerophon Zone
  - 1 Middle Ordovician (projected)
- FOSSIL CONTROL

  - 5 probably Zonitoid Zone
  - 4 probably coralline with Saccophylloids
  - 3 goniatitoid Zone
  - 2 Bellerophon Zone
  - 1 Murchisonia sp.

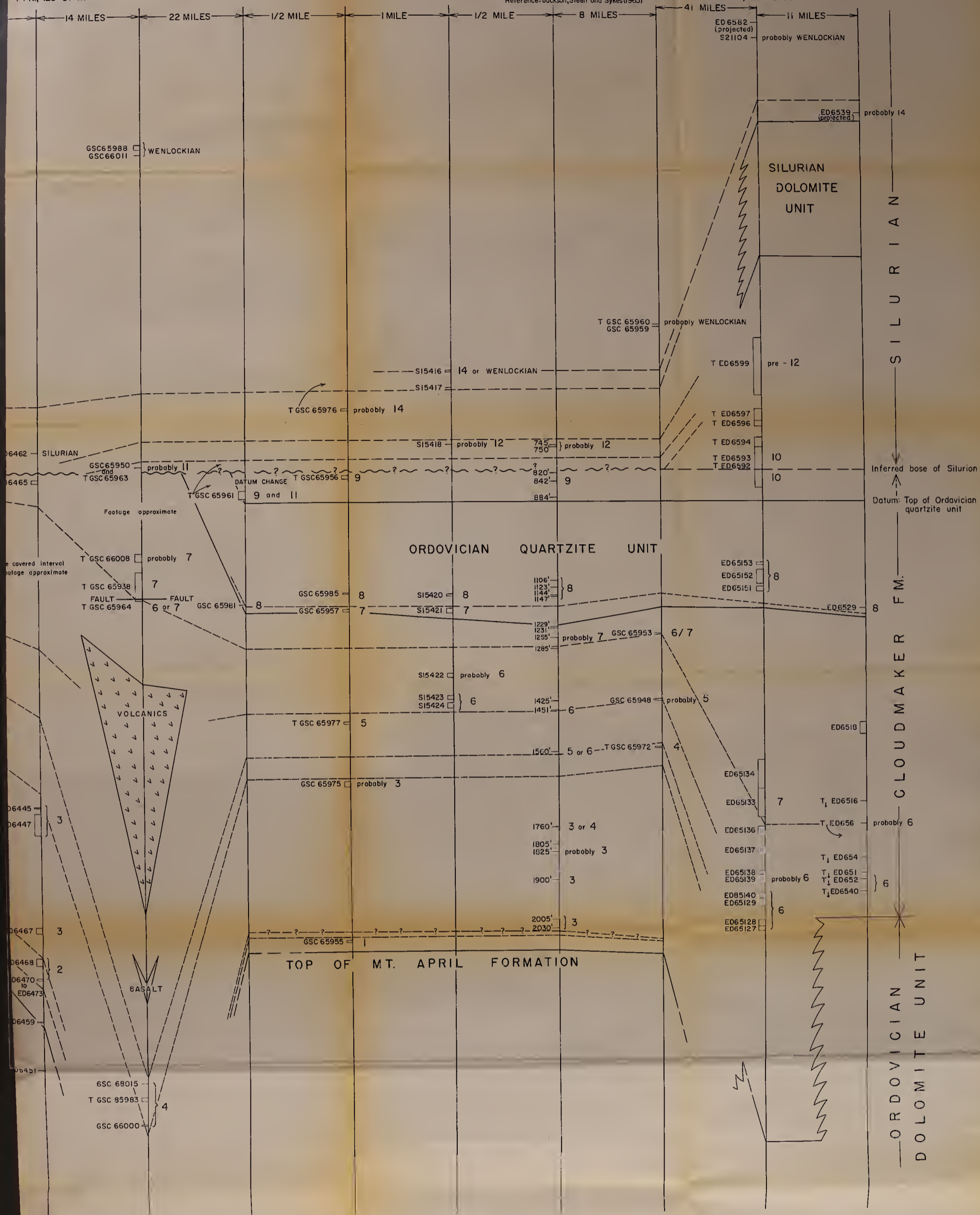


## NOTE

Broken lines denote uncertainty  
 Standard lithological symbols are used (see appendix for more detail)  
 Line of cross section is shown in Figure 2

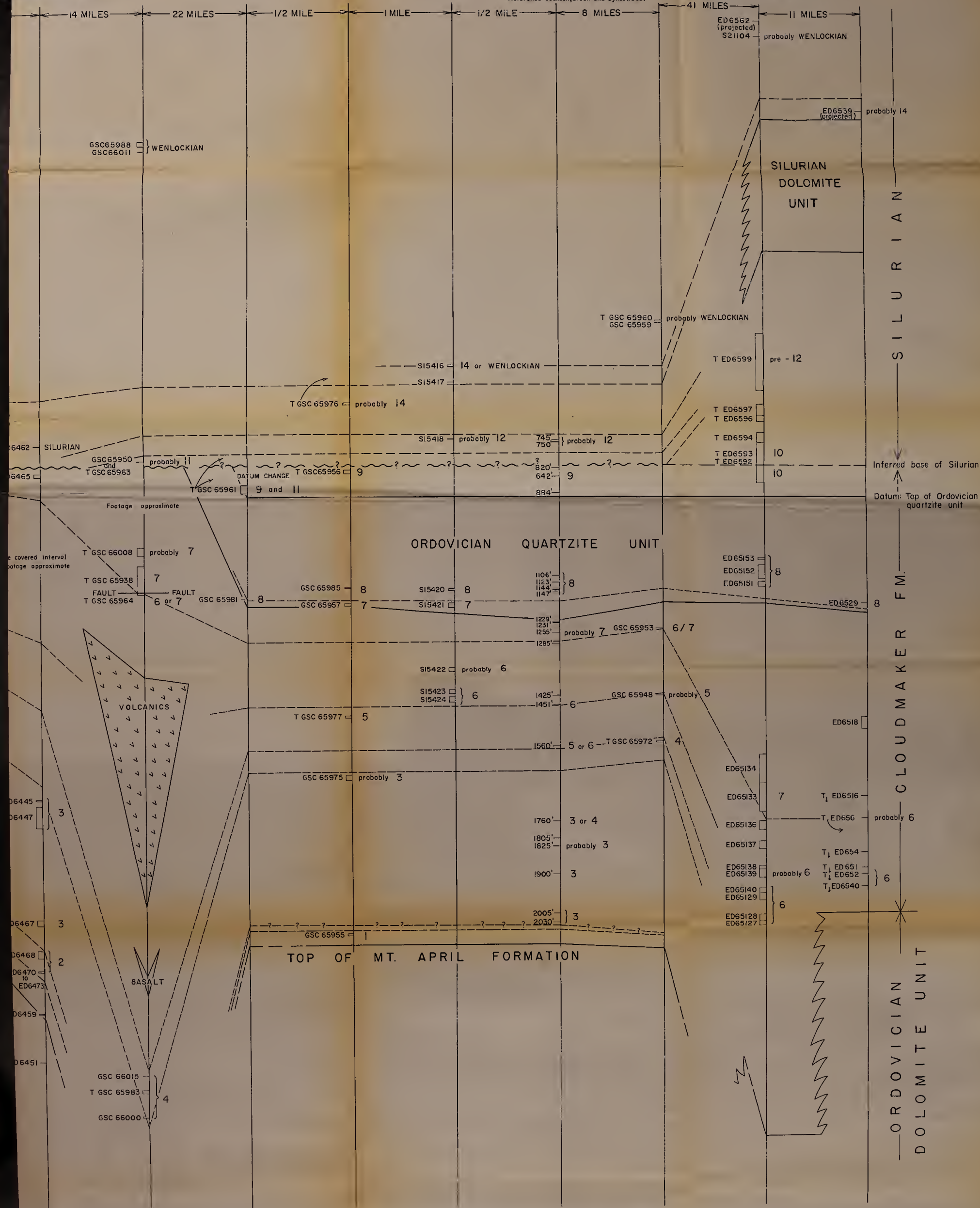
Scale:  
 Lithological sections 1 inch = 500 feet  
 Distribution of rock units between control points is shown schematically  
 Horizontal Scale 1 inch = 5 miles

- FOSSIL CONTROL
- 2 probably coralline with Saccophylloids
  - 1 Upper Ordovician



SCHEMATIC STRATIGRAPHIC CROSS SECTION  
SHOWING LITHOLOGICAL UNITS AND RANGE OF  
MEASURED SECTIONS (THICK LINE)

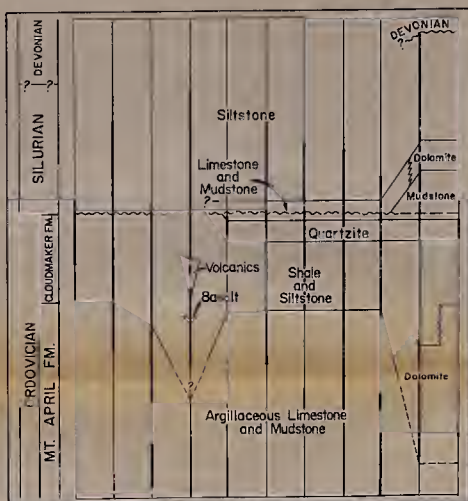
VERTICAL SCALE: 1 INCH = 1000 FEET.



# LEGEND

- 14 ZONE OF MONOGRAPTUS SPIRALIS
- 13 ZONE OF MONOGRAPTUS TURRICULATUS
- 12? ZONE OF MONOGRAPTUS GREGARIUS
- 11 ZONE OF MONOGRAPTUS CYPHUS
- 10? ZONE OF DIPLOGRAPTUS MODESTUS
- 9 ZONE OF DICELLOGRAPTUS COMPLANATUS ORNATUS
- 8 ZONE OF ORTHOGRAPTUS QUADRIMUCRONATUS
- 7 ZONE OF ORTHOGRAPTUS TRUNCATUS INTERMEDIUS
- 6 ZONE OF CLIMACOGRAPTUS BICORNIS
- 5 ZONE OF NEMAGRAPTUS GRACILIS
- 4 ZONE OF GLYPTOGRAPTUS EUGLYPHUS
- 3 ZONE OF PARAGLOSSOGRAPTUS ETHERIDGEI
- 2 ZONE OF ISOGRAPTUS CADUCEUS
- 1 ZONE OF DIDYMOGRAPTUS PROTOBIFIDUS

- Approximate position of zonal boundaries.
- T Talus collection.
- T Talus collection with approximate position indicated.
- T Talus from stratigraphically older horizon (section overturned)



SCHMATIC STRATIGRAPHIC CROSS SECTION  
SHOWING LITHOLOGICAL UNITS AND RANGE OF  
MEASURED SECTIONS (THICK LINE)  
VERTICAL SCALE: 1 INCH = 1000 FEET.

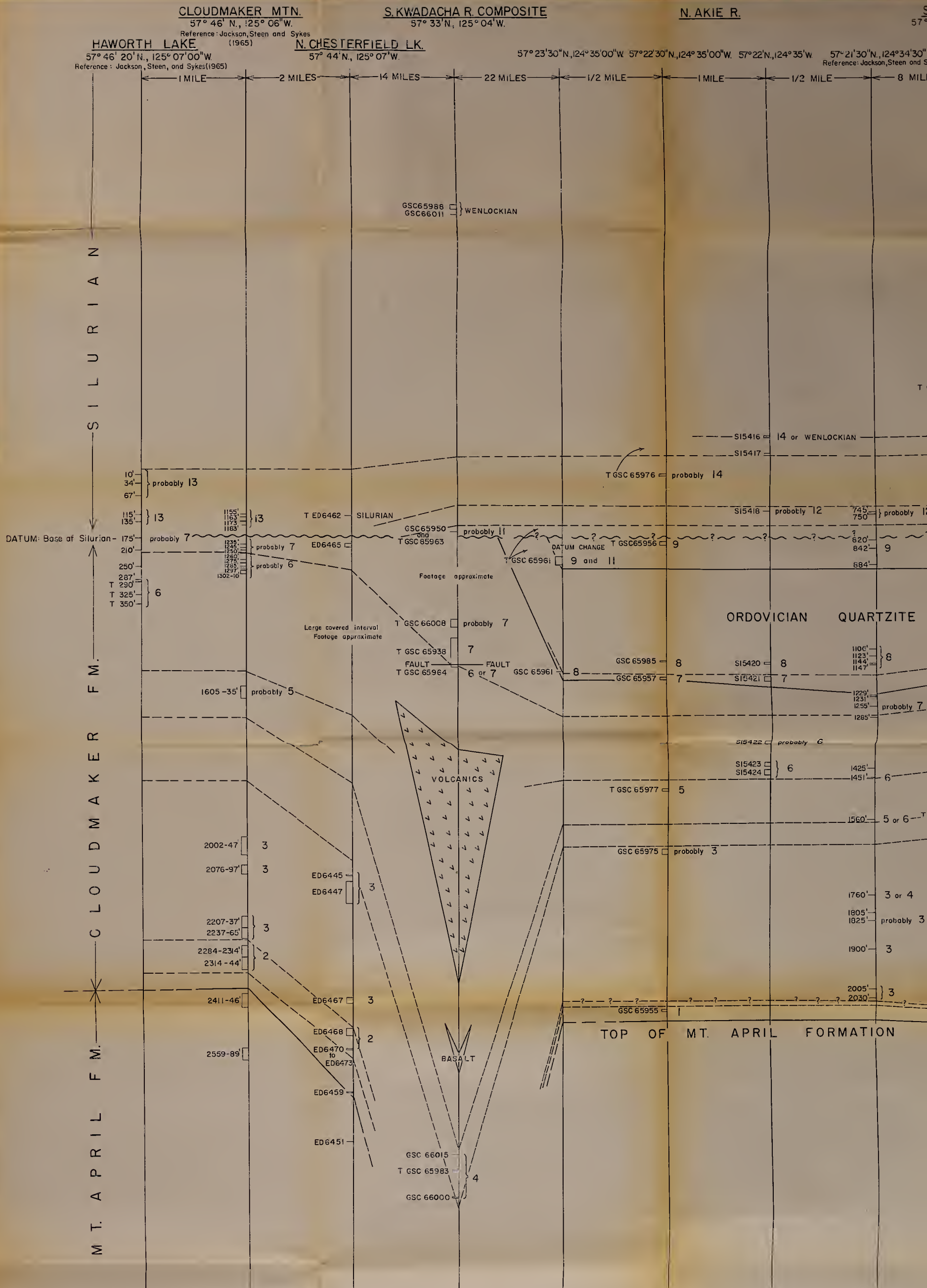
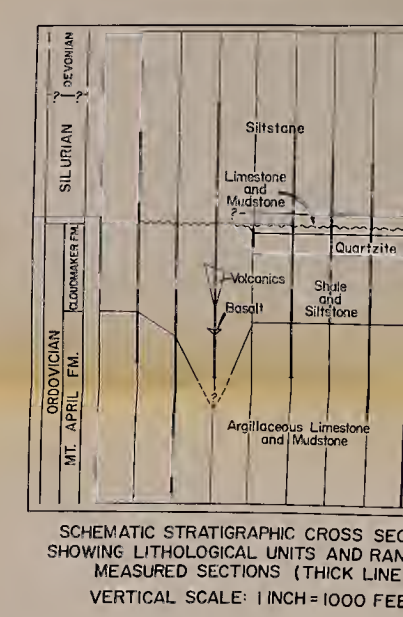


Figure 14-

STRATIGRAPHIC DISTRIBUTION AND ZONAL ASSIGNMENT OF GRAPTOLITE C

Vertical Scale: 1 inch = 100 feet.



**B29859**